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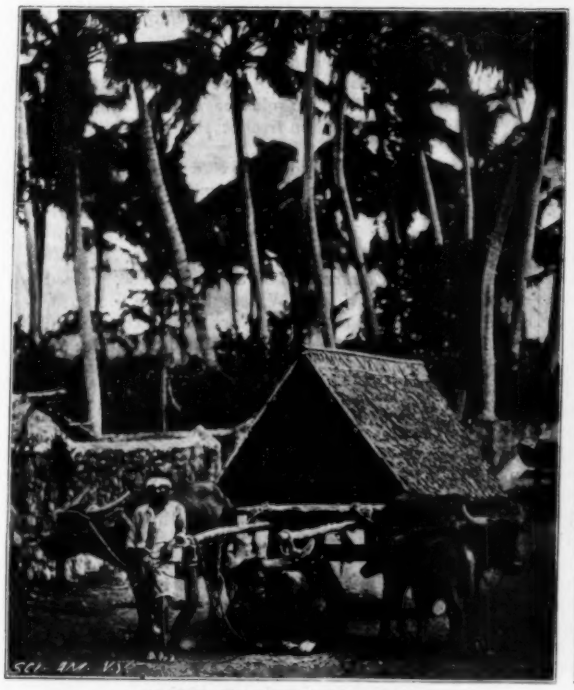
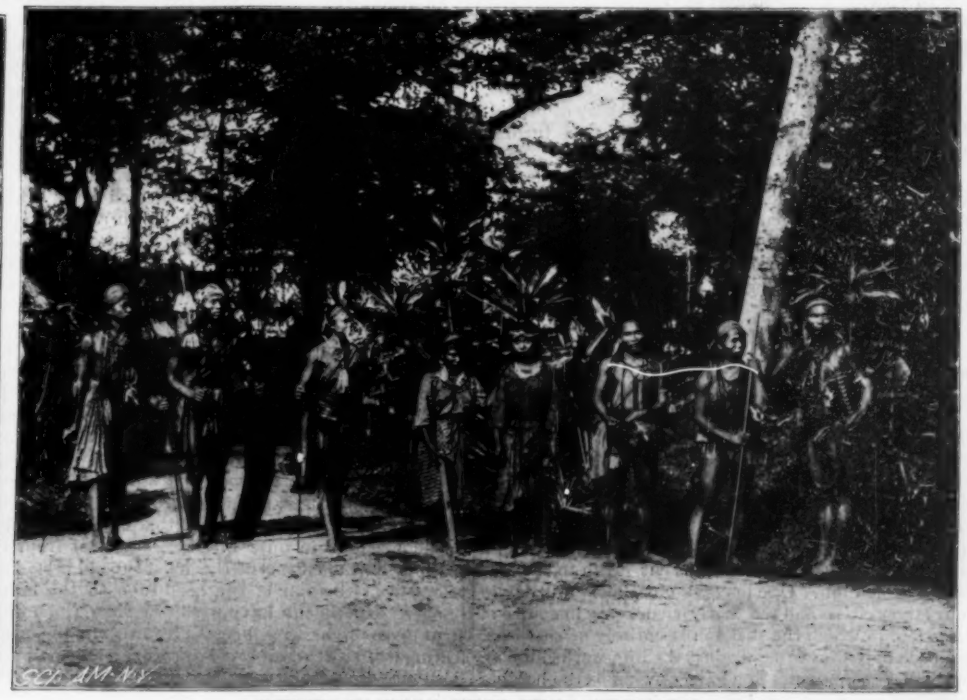
NEGRITOS OF MARIVILES SHOOTING FISH FROM AN INDIAN BOAT

NATIVES OF ABRA.



BUFFALOES AND CARTS, CEBU.



SAVAGES OF NORTH LUZON, WITH THEIR ARMS.

CATHEDRAL, MAJAYJAY, LUZON.

CIVILIZED INDIANS POUNDING AND CLEANING RICE, LUZON.

THE PHILIPPINE ISLANDS—THE SAVAGE AND CIVILIZED INDIANS AND THEIR HOME.—[See page 184.]

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WIND BRACING IN FRAMED BUILDINGS.

The use of steel and the introduction of what is known as the "skeleton" system in the construction of large buildings has introduced many structural problems which never troubled the head of the architect in the days of brick, stone, and mortar. Most of these problems have been met and successfully solved by the application of those scientific methods of which we see the most successful applications in the great railroad and highway bridges that have been built in such numbers during the present generation in this country. The strains in the skeleton frame of a modern twenty-story building are calculated with all the care and detail that is bestowed upon the design of a complicated cantilever bridge or the three hundred foot trusses that carry the roof of a terminal train-shed. The weight of each girder, beam, and post, of each wall, partition, and roof, of fittings, furniture, and the possible floor loads of each story are closely predetermined, and the exact distribution of these loads among the various lines of supporting columns is estimated with a wonderfully close approximation to the truth. Knowing the maximum strains that will be brought to bear upon each member of the skeleton, it is a simple matter to provide steel columns of the proper diameter and sectional area of metal to carry the load with a proper margin of safety.

There is one element in the design of skeleton steel buildings, however, which frequently receives too little, if any, attention. We refer to the necessity of providing against the tendency to distortion, or overturning by the wind.

There is no denying the fact that in the earlier tall buildings the provision for wind strains was practically omitted; what lateral stiffness the building did possess being imparted by the riveting of the floor system to the columns and by the inertia of the inclosing shell of masonry. Many of the later buildings are stiffened by connecting the columns at each floor by deep girders—plate girders being used in the lower stories, where the accumulated bending strains of the superincumbent structure have to be resisted, and lighter lattice girders being used on the floors above.

While many of the later and larger buildings are thus strengthened against the bending effects of the wind, there are others in which no such provision exists. This is especially true of the smaller ten and twelve story structures which are being run up by small contractors. The buildings are put up for purely speculative purposes, and every item of cost, including the fees of a skilled architect and engineer, is cut down to the lowest possible limit. One may go out almost any day in our larger cities and see flimsy structures in course of erection, in which the skeleton is entirely of cast iron, and the only protection against the iron work shutting up under the pressure of a gale of wind is the holding power of a few bolts and cast iron lugs and flanges.

In the old system of brick and stone construction the solid walls gave all the necessary stability. They resisted the tendency to overturning or rupture by their dead weight and their inherent transverse strength; but as soon as the skeleton system of construction came in, builders appear to have lost sight of the fact that some form of diagonal bracing was necessary to replace the natural rigidity of solid walls and partitions. Nor does the brick or stone shell with which modern buildings are inclosed give the necessary stiffness, for it is in reality only a system of thin paneling, as it were, built into and carried by the steel frame.

Another point to which too little attention is given in the erection of skeleton steelwork is the provision of adequate temporary bracing during erection. The steelwork is run up and temporarily bolted too far ahead of the riveting, and while the towering columns are safe against ordinary wind pressures, they would be in serious danger of collapse if a storm of unusual severity were to strike them. Timber struts, one-inch screw bolts, and slight guy ropes that are amply sufficient to maintain the towering pile in the perpendicular in still air or ordinary breezes, will splinter and shear and snap asunder the moment a summer tornado bears down upon it.

That these remarks do not apply merely to tall buildings is shown by the collapse last week of one of the great pier sheds which are being erected for the use of the Atlantic liners on the North River, New York city. In saying this we are mindful of the fact that the storm which wrecked the building was cyclonic in its fury and that the structure was being erected by one of the most experienced firms in this class of work in the country. The plans of the shed, which was a huge affair, some 700 or 800 feet long, by 120 feet broad, had been approved by the Dock Board, and they correspond very closely to those of the many large sheds which have lately been erected by the same firm of contractors for other steamship companies. There was no motive for cheap or careless work, and as far as we could judge on a brief inspection of the ruins, the disaster was due to a storm of extraordinary force acting upon a partially erected steel structure whose temporary and permanent stiffening and wind bracing did not prove sufficient for the emergency.

We shall hope to take up the matter again in an early issue, and give an illustrated and more lengthy description of the construction of the shed and the present state of the wreck.

THE BICYCLE FRAME.

Our editorial of August 27 on the increasing weight of the bicycle has brought several letters to this office which deal not so much with the main point of the article as with a concluding suggestion which was made regarding the introduction of a strut within the diamond frame. The paragraph referred to ran as follows:

"It is strange that no maker has succeeded in introducing a feature into the bicycle which is not only thoroughly scientific, but would undoubtedly strengthen it, and at the same time allow a certain reduction in its weight. We refer to the introduction of a cross tie or strut within the frame, running either from the joint at the seat post to the joint at the bottom of the head, or from the top of the head to the crank hanger. The introduction of such a member would make the frame what it is not at present—a truss. It would cause all the strains, whether of tension or compression, to act along the axis of each tube, and it would have the important result of relieving the tubes at the joints of all bending strains acting in the plane of the frame."

Our attention is drawn to two machines in which the frame is an actual truss, that have had the test of hard riding on the road and given good results. The first was built by Mr. W. H. Hale, of New Haven, and in addition to having a strut running from the seat cluster down to the bottom of the head tube, it is an articulated frame, the connections being made by eye and bolt instead of by brazing—the construction thus approximating to that of a pin-connected truss bridge. The pin connections were adopted with a view to providing a "knock-down" machine that would be convenient for transportation, and it will interest our readers to know that this machine may be packed in a box thirty-two inches long by twenty-eight inches wide and seven inches in depth. We must confess, however, that while, under certain circumstances, the snug packing of a wheel would be a great convenience, we would not favor the substitution of bolted for brazed connections. At the same time, we are assured by the designer that while he has built these machines with brazed frames, he greatly prefers the bolted or "sectional" type, because of the ease of straightening frames, replacing broken tubes, or doing the hundred-and-one repair jobs that come to hand.

The machine in question carries a strut from the seat post to the bottom of the head tube in preference to one from the top of the head tube to the crank-hanger, experiment having shown that the former strut gives the best results. As regards the important features of stiffness and weight, we are assured that both are satisfactory. The first machine, which weighed twenty-two pounds complete, has been ridden some twenty thousand miles during the past two years by riders who have weighed up to 220 pounds, and has stood the test without any signs of failure.

This, of course, does not prove that a diamond frame of the same weight and of the common type (that is, without any interior strut) would not stand the same usage; but the presumption is that it would not. In case of collision or running over a large obstacle in the road, the diamond frame as now built is subjected to very severe bending strains at the point where the reinforcement ends, and that buckling is likely to take place at this point many a rider has found to his cost. The introduction of a strut instantly removes these bending strains, and the whole effect of a collision is resolved into simple strains of compression and tension acting along the axis of the tubes.

The thin, large diameter tubing now in use is particularly weak in resisting bending strains and wonderfully strong for its weight in resisting compressive or tensile strains acting along its axis. A parallel illustration of this fact may be shown by rolling up a sheet of drawing paper into a cylinder, standing it on end, and loading it with weights. It will stand an axial pressure out of all proportion to its weight. But if the cylinder be held at its ends and subjected to a bending or transverse strain, it will collapse under a very small load.

The internal strut, however, cannot be used to any advantage in the very low frames that are just now the fad; but when the heads have been again lengthened to reasonable proportions (a change that is likely to be made sooner or later), the obvious stiffening effect of the strut should lead to its early introduction.

Another communication has been received from Mr. Charles E. Duryea, who draws attention to his triangular frame, which consists of a single triangle made up of the rear braces, the forks, and the head, the head and the rear braces meeting under the saddle to form the apex of the triangle. There are unquestionably several points of merit, structurally considered, in this design; but we think that it would be greatly stiffened if the bottom member of the triangle ran straight (instead of in a curve) from the rear hubs to the bottom of the head, and if a center vertical strut were introduced between the apex and the crank-axle bearing. Such a strut would relieve the bottom member of the vertical bending strains and the torsional strains due to the pressure on the cranks. At the same time we think that the best results could be obtained by returning to a reasonable length of head (say twenty-four or twenty-five inches) and introducing a strut into the present type of diamond frame. The diameter of the tubing should be somewhat reduced and its gage increased, although, with the strength imparted by the strut, we question if the present gage would not be found sufficient even with a smaller diameter of tubing.

THE WATER SUPPLY AT CAMP THOMAS.

We have received from Mr. P. A. Maignan, of Philadelphia, a copy of his report recently made to Gen. Breckenridge on the supply of potable water at Camp Thomas. Mr. Maignan was sent to Chickamauga by Gens. Sternberg and Ludington for the purpose of investigating the workings of the water filters at Camp Thomas, and as the report deals at considerable length with the nature of the soil, the drainage of the camp, the quality of the water, and the methods, both mechanical and chemical, by which the water is or may be purified, we shall publish it in full in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

It appears that nearly the whole camp is located above a magnesian limestone. The surface water passes directly through sink holes and fissures into the small water-pockets struck by the so-called artesian wells. Hence it has no chance of filtering and purifying itself, and after a freshet the wells give turbid water. There is obvious danger in drinking this water from a bacterian point of view, and the report dwells upon the fact that this water, like that of most springs in limestone formation, being very "hard," not only fails to cook the food properly, but has an injurious effect upon nutrition.

The Medical Congress of Brussels, in 1886, passed the following resolution: "Waters that are too hard, or contain mineral matters that are not in the human organism, form with the chyle an abnormal medium for hematosis (formation of blood), and they fatigue the kidneys, whose duty it is to eliminate them unceasingly, and they incrust the articulations." The effect of hard water on digestion is shown by placing the white of an egg in two test tubes with about an equal quantity of bile taken from a freshly killed animal, agitating the mixture and adding to one test tube some distilled rain water or spring water that has been softened, and to the other tube some untreated spring water or hard well water. If the tubes be again agitated, the emulsion in the first case will be perfect and readily assimilate; being perfectly soluble, it will pass into the blood, and give strength. On shaking the second tube, the contents will coagulate. The report states that this hardness of the water has had a great deal to do with the emaciated state of those men who, without any bacterian disease, have lost twenty or thirty pounds in weight. The prevalence of lumbago and rheumatism is attributed to the same hardness of the water.

The first attempt to provide good potable water by the use of asbestos and porcelain filters was a failure, as the muddy condition of the water from the creeks quickly clogged up the filtering material and rendered them useless. The report states that by treating the water with a small amount of lime and iron a heavy precipitate is formed which agglomerates and carries down the finely suspended clay, and that this treatment supplemented by filtration would have provided an excellent drinking water.

Fault is found with the spring water, which, after the creek water was abandoned, was hauled in barrels from different sources of supply. It appears that it was the custom to place an old canvas sack over the top of the barrel below the lid to prevent the spilling of the water. These sacks were often on the ground or on the floor of the wagon, and the impurities they picked up were washed out into the barrel by the splashing of the water against them.

It was the practice in the camp to have this water boiled, but boiling, while it afforded security against microbian diseases, did little in removing the mineral impurities. The recommendations of the report on

this head are as follows: In addition to boiling the water, it should be analyzed to determine the exact quantity of hydrate of lime (or common quick lime) to add to the water to precipitate the whole of the bicarbonate, and the amount of carbonate of soda (or common washing soda) to decompose and precipitate the sulphate of lime and magnesia.

The best installation found in the camp was that of the 12th New York. The boilers were placed in a row over a wood fire, and the water was carried boiling into four casks, from which it fell through wooden spigots into four asbestos filters. From the filters the water passed to four other casks in which the ice was introduced. It is suggested that if the 12th New York had put a little lime and soda into the boiling water in the casks, they would have had a drinking water which would have been perfect, being both softened and sterilized.

The 14th New York, under the enterprising command of Col. Wilder, erected a distilling apparatus of sufficient capacity for the whole regiment, which, of course, settled the question of mineral soils and microbes at a stroke.

As a conclusion of the investigation, the report says that the terrible increase of sickness which has caused the camp to be abandoned has had the water supply for the main if not the exclusive cause. The July rains washed the microbe-laden atmosphere and the polluted soil and carried the morbid material into the pockets of water struck by the pumps. The spring water was polluted by the canvas bags and the muddy bottoms of pails. These causes account for the malarial and typhoid cases, while the loss of vitality, the lumbago, rheumatism, and stomach disorders are due, for the most part, to the hard water of the pumps and springs.

In concluding his report, Mr. Maignan states that by taking the precautions as outlined above there is no reason why the National Park at some future time, after suitable disinfection and proper sanitary arrangements for the disposal of excretæ and other waste, should not be a first-rate camping ground.

GEOLOGY AT THE MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY E. O. HOVEY.

The numerous receptions and excursions given and arranged for through the hospitality of the citizens of Boston reduced the time for the actual reading of papers to about two days and a half for Section E, which is the department of the association devoted especially to geology and geography. In this time eighteen papers were presented by the Geological Society of America, eight by the National Geographic Society, and twenty-nine by Section E proper. As usual, the geological papers covered a wide range of topics, from the oldest to the newest strata, and included discussions in petrography and mineralogy as well. Before the regular business of the section was taken up, tributes were paid to the memory of Prof. James Hall, the veteran geologist and paleontologist of New York, who died suddenly at Bethlehem, N. H., August 7, of this year, at the age of 87. The speakers on the occasion of the memorial were H. L. Fairchild, B. K. Emerson, W. H. Niles, and H. C. Hovey, all of whom testified to the eminence and high scientific attainments of this the last of the famous coterie of founders of the science of geology in America.

The chairman of the section this year was Prof. H. L. Fairchild, of Rochester, N. Y. He chose for the subject of his set address "Glacial Geology in America." (See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1183, 1184, 1185), and presented a concise review of the history of the progress made in this department of geology.

Fifteen other papers dealt more or less directly with glacial geology, some of which aroused much discussion. The first was entitled "Some Features of the Drift on Staten Island, N. Y.," by Arthur Hollick, of Columbia University. He said, in part: The terminal moraine crosses Staten Island from Fort Wadsworth, at the Narrows, to Tottenville, opposite Perth Amboy, N. J. Its front rests partly upon the serpentine ridge and partly upon the plain region to the south. In the former locality it consists of true morainic material derived from foreign sources. In the latter it consists of a ridge or core of Cretaceous and Tertiary clays, sands, and gravels shoved forward and upward from their original positions on the island, on top of which is the morainal till and gravel. At two localities there are well defined indications of extra-morainic drift, south of the terminal moraine. The direction of glacial movement is indicated by the striæ on rock outcrops to be from about N. 17° W. The most abundantly represented bowlders are those derived from the Triassic, of New Jersey, but others have come from nearly all the outcrops between Staten Island and the Adirondacks. About 120 species of Paleozoic fossils have been obtained from the transported bowlders, and about 35 Cretaceous and Tertiary species, mostly plants, have been found in the drift which were derived from the disturbed Staten Island strata.

In addition to his vice-presidential address, Prof. Fairchild presented two papers on glacial geology. The first pertained to the Finger Lake region of central New York, and supplemented an earlier paper of his on the same subject, detailing many new observations. He has now traced out the beaches which determine the limits of the ponded glacial waters in these curious valleys, and indicate their halt at at least four levels for long periods. The work is much complicated by the post-glacial elevation of the land, which has raised the northern beaches above their original relation to the southern.

In his other paper, Prof. Fairchild described a great "kettle hole" in the gravel plateau above the village of Potter. The explanation of the phenomenon is that an isolated block of ice was left here by the receding glacier, and that the delta sands and gravels were piled around it. The subsequent melting of the ice block produced the cavity.

Warren Upham, of St. Paul, Minn., discussed the evidences of continental elevation and depression immediately preceding and following the ice age. He stated that recent mapping and investigation showed that the pre-glacial elevation in different parts of the world was greater than was supposed forty years ago, and was sufficient to account for the glacial climate. This elevation for the northern half of North America amounted to from 3,000 to 5,000 feet above the present level.

The question as to whether the summits of the White and Green Mountains were covered by the great ice sheet has been much discussed. Fresh evidence in support of the glacier having covered these summits was discovered by Prof. C. H. Hitchcock, of Hanover, N. H., during the past year, who ascended Mount Orford, 5,000 feet high, near Lake Memphremagog, and found it glaciated from bottom to top. The movement of the glacier was from the northwest. A twenty pound bowlder was found on the summit and submitted to Prof. F. D. Adams, of McGill College, Montreal, who determined it to be Laurentian gneiss from the north side of the St. Lawrence River. Previously, Prof. Hitchcock has found similar bowlders on the summits of other of the high peaks of the White Mountains, including Mount Washington. The movement of the Hudson River lobe of the Laurentide ice sheet was to the southeast, over the tops of the White and Green Mountains, to the southwest over the Adirondacks (though Mount Marcy seems to have kept its head above the ice) and due south along the low-lying valley.

The gorge of the Niagara River, from the falls to the escarpment at Lewiston, has always been a region of the highest interest to the geologist as well as to the tourist, hence the importance attached to a paper by Prof. G. F. Wright on "The Age of Niagara Falls as Indicated by the Width of the Gorge at Lewiston." The late Prof. James Hall early noted the significant fact that "the outlet of the chasm below Niagara Falls is scarcely wider than elsewhere along its course." This is certainly important evidence of the late date of its origin, and has been used by the author and others in support of the short estimates which have been made concerning the length of time which has passed since the glacial period. A close examination made by Prof. Wright the past summer greatly strengthens the force of the argument, since he found that the disintegrating forces tending to enlarge the outlet and give it a V-shape are more rapid than have been supposed. Somewhat more than forty years ago a railroad was built along the face of the eastern side of the gorge. Where a vertical exposure was then made, the shale has since crumbled away to an extent of several feet and in some places to that of twenty feet. A conservative estimate of the rate of disintegration for the seventy feet of Niagara shale supporting the Niagara limestone would be one inch a year, with a probable rate twice as great. At the lowest estimate, only 12,000 years would be required for widening the upper part of the mouth of the gorge 1,000 feet on each side, which is largely in excess of the actual amount of enlargement. Some of the recent estimates, therefore, which would make the gorge from 30,000 to 40,000 years old, are evidently extravagant and must incorporate some error in their premises. The gorge cannot be much more than 10,000 years old, and is probably considerably less.

"Another Episode in the History of Niagara River" was the title of a paper by Dr. J. W. Spencer, in which he announced the discovery that, while the falls were receding from Foster's Flats to the point of the railway bridges, the fall of the river reached its maximum height of 420 feet by the retreat of the Ontario waters toward the north. The return to the present height of 326 feet was interrupted by the subsequent rising of the level of the lake in the gorge to a height of 75 feet, thus reducing the actual fall of the river to 250 feet. The evidence of this is preserved in the remains of a terrace deposit opposite the foot of Foster's Flats and a corresponding terrace just outside the mouth of the gorge. The paper was really a sequel to one by the same author presented to the association four years ago on "The Duration of Niagara Falls."

The study of the history of drainage systems is one feature of the border region between geology and physical geography. Prof. W. G. Tight, of Granville, O., read a paper on "The Development of the Ohio River," in which he said in substance:

"A brief review of the literature shows that the generally accepted view is that the Ohio River is a very ancient stream. The work of certain geologists in New York and Pennsylvania indicated the recent origin of the Ohio above New Martinsville. In papers already published by the author the existence of a very ancient erosion basin extending in general from east to west through the central part of Ohio and Indiana is established by the restoration of many tributary drainage lines and by deep wells. Further evidence is presented to show that the Ohio in its present location has been established by the appropriation of sections of numerous north and northwestward flowing streams and their tributaries by the cutting of the ancient cols and the broadening and deepening of the valleys. The explanation for the modifications is found in the position and action of the glacial ice sheet in the various sections, thus determining also the relative age of the Ohio valley to be glacial or post-glacial. The lines of discharge of the glacial waters determined the present lines of southward flowing tributaries of the Ohio. The theory is proposed that the reason for the development of the Ohio River entirely beyond the greatest extent of the ice sheet on the eastern side of the Mississippi and the Missouri almost entirely within the limits of the ice, west of the Mississippi, is due to the different angle which the tributary streams made with the advancing ice front and their gradients; thus forcing the water over distant cols in the former case and retaining the water next to the ice front, thus wearing back the ice at the time of final recession, before the establishment of the channel by down cutting in the latter."

"The Oldest Known Rock," by N. H. Winchell, State geologist of Minnesota, was a communication in which, after a brief description of the other members of the Archean system, the author dwelt more at length on the so-called greenstones of Minnesota, which he considers the bottom of the geological scale and the representative of the original crust of the earth formed from the molten mass by the earliest consolidation. The greenstones, as such, are divisible into two parts, one igneous and the other sedimentary, the latter succeeding the former in point of time, with a confused and sometimes apparently non-conformable superposition, somewhat in the manner that a lot of surface rocks might be superposed in presence of oceanic action on a massive stone of the same nature at the same place. The sedimentary portions of the greenstones vary to more siliceous rocks, constituting great thicknesses of graywackes, phyllytes, and conglomerates, and as such have been converted by widespread metamorphism into mica schists and gneisses, the alteration, coming on by degrees, increasing in intensity toward centers of granitic intrusion and toward the great areas of granite and igneous gneiss which extend over large tracts. The Canadian Laurentian, as a whole, appears to be of later date than the greenstones of Minnesota, since the igneous portions cut them; hence these greenstones must be considered to be the oldest known rock.

The second paper by Prof. Winchell discussed the "Origin of the Archean Igneous Rocks," a topic of great difficulty, but of great interest to all students of the earth's history. The greenstones, which are spoken of in the preceding paper, are supposed to represent the original crust of the earth, and the author denies the possibility of the derivation of the alkaline granitic magma from this ferromagnesian greenstone magma by any of the methods of lixiviation or of differentiation which are currently proposed by geologists who have lately discussed the origin of the igneous rocks. The author holds that the potash resided in the ocean itself, which immediately followed the consolidation of the first crust. Such an alkaline ocean, especially if heated, would hold in solution much silica. Hence followed precipitation of alkaline silicates and of excess of silica. Hence the alkaline character of the schists and gneisses when its sediments were formed into rock and metamorphosed, and hence, when fused, the alkaline magma. The author does not attempt to account for this potassic ocean. He only throws out the suggestion that potassium, from its chemical characteristics, might have remained in the atmosphere until the consolidation of the first crust and the subsequent condensation of the moisture and less volatile vapors formed the ocean.

Our brief review has included only a few of the more popular papers presented before Section E. Although the section is intended to embrace geography as well as geology, only one paper that could be called geographic was presented before it, and it is to be hoped that there will be a marked change in this regard in the future. The value of the meeting was much enhanced to some members of the section by the impromptu geological excursions which were taken to various points of interest in the vicinity of Boston under the guidance of Prof. W. O. Crosby and Mr. J. H. Sears.

The chief officers of the section this year were Prof. H. L. Fairchild, vice-president, and Warren Upham, secretary. For next year the offices are held by J. F. Whiteaves, of Ottawa, Canada, and Arthur Hollick, of New York city, respectively.

A NOVEL SELF-CLOSING GATE.

An invention has recently been patented by Dr. Peyton B. Green, of Wytheville, Va., in which a simple and ingenious device is provided for closing a gate automatically.

Referring to the accompanying engraving, it will be observed that, on the top bar of the gate, a roller is journaled which is engaged by an inclined rod fulcrumed at its lower end on a fixed support set at a proper distance from the hinge-post. A weight is held on the rod and can be fastened in any desired position by means of a set screw. To prevent the rod from leaving the roller when opening and closing the gate,

GREEN'S SELF-CLOSING GATE.

the bracket in which the roller is journaled is provided with a loop.

When the gate is swung open, the free end of the rod travels over the friction-roller and assumes nearly a vertical position. As soon as the gate is released, the weight of the rod pressing against the roller closes the gate. By changing the position of the weight, the gate can be closed with more or less force.

A GREAT RAFT OF PILES ON THE PACIFIC.

The largest marine structure that ever entered the bay of San Francisco arrived in that port the first of August. It consisted of an immense raft of piles, ten thousand in number, which had been chained together at Stella, State of Washington, a point about seventy miles from the mouth of the Columbia River. The dimensions were: Total length, 600 feet; breadth, 50 feet, with a depth of 45 feet. The 10,000 piles, which varied in length from 30 to 90 feet, were from 12 to 18 inches in diameter at the butt. The raft drew 30 feet of water, and it contained upward of 5,000,000 lineal feet of timber. The distance from starting point to destination is about 700 miles, and 5¼ days' towing was employed in bringing it to port.

To transport the same number of piles by steamers would have employed twenty at least, of the ordinary size. The journey from the shipping point was made without accident, owing to the unusually favorable weather, and the successful result of the venture has encouraged the Northern timber dealers in continuing this method of shipment.

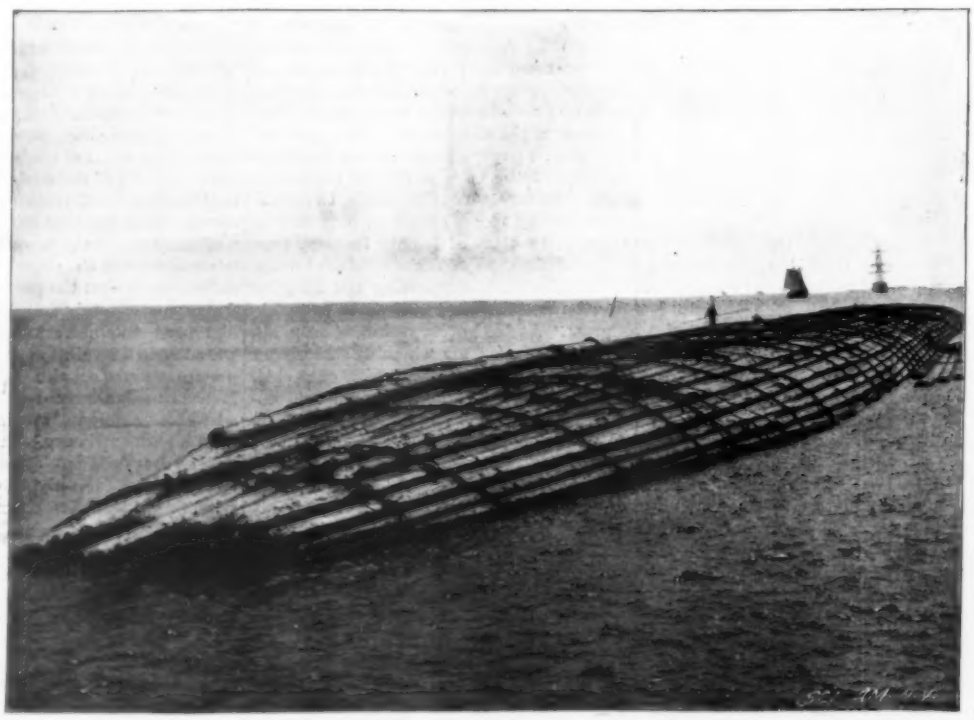
Owing to the excellent financial results of rafting, attempts have been made in past years to introduce this method on the Pacific coast. So far five attempts have been made, and success has attended three of them. One grounded on the bar at Coos Bay and another was lost at sea. This last was far and away the largest yet attempted and will be succeeded by another fully as large. Shipments of piles only have so far been made in this way, but it is the intention to experiment in shipping lumber either sawed or in the rough, the saving in freight alone allowing a margin for large losses.

The method of building these rafts at Stella differs radically from that pursued at the East, when the attempts were made to raft timbers from Nova Scotia to Eastern ports. The Canadians constructed theirs upon ways built upon the land, which were launched when completed, just as vessels are in Washington. However, the rafts are constructed in a different manner. First of all a cradle is built of the length of the proposed raft, with side timbers of about 20 feet in height, separated from each other by blocks. The interior of this cradle is of the shape of the raft, largest in the center and tapering to a point at both ends. By means of an engine and tackle the piles are hoisted over the sides of the cradle and land in their proper places by hand. When the raft is built up to one-half the proper height, a chain cable, 2 inches in diameter, is stretched from end to end, and at every 10 feet a chain is made fast to the central cable and extended to the outside, where two ends are fastened to the cable which surrounds the raft. The strain by this connection extends from the central to the outside chains and adds to the rigidity and strength of the whole. Sixty tons of chain, in separate lengths of 50 to 150 feet and 1⅛ inches in diameter, were used. The outside was surrounded by these cables at intervals of 10 feet.

The stretching of the cables around the outside is not accomplished until the whole structure has been built up. At every 10 feet between the timbers of which the cradle is constructed a wire is stretched around the raft. The end of the chain is fastened to the end of the wire, and is thus drawn around the raft and fastened at the top.

The cradle timbers, after the raft is finished, are drawn from either side of the raft, which rests upon the water, ready for towing.

The timbers are again set up, and the building of a new raft begun.



GREAT RAFT OF PILES ON THE PACIFIC.

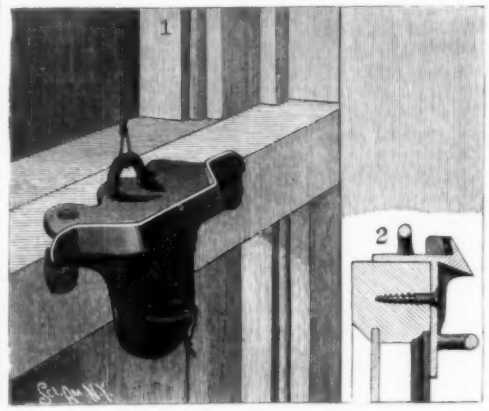
Length, 600 feet; breadth, 50 feet; depth, 45 feet; number of piles, 10,000; total amount of timber, 5,000,000 feet, B. M.

The Coldest Country in the World.

Symon's Monthly Meteorological Magazine gives an interesting account of "Life in the Coldest Country in the World," which has been taken from the bulletin of the Royal Geographical Society of Irkutsk. The name of the place is Werchojansk, in Siberia, longitude 133° 51' E., latitude 67° 34' N., where the lowest temperature of minus 90° Fah. has been observed, and the mean of January is minus 48° Fah. It is inhabited by about 105,000 persons of the Jakut and Lamat races. In a large part of the region, according to Prof. Kovalik, the air is so dry and the winds are so rare that the intensity of the cold cannot be fully realized. In the most distant part of the East there are sometimes terrible storms, which are most fatal to life in their consequences. During the summer time the temperature occasionally rises to 86° Fah. in the shade, while it freezes at night. The latter part of the season is often marked by copious rains and extensive inundations, which invariably lay waste a vast acreage of land and prove to be a serious obstacle to the cultivation of the soil. Vegetation is very scanty. There are practically no trees—only wide, open meadows. The people hunt fur-bearing animals, fish, and raise cattle and raindeer. It requires about eight cows to support a family, four being milked in the summer and two in the winter. The cattle are very small in size, and are fed with hay in winter. Occasionally they are allowed to go out when there is the slightest break in the weather, but their teats are always carefully covered up with felt. Milk is the principal food. This is sometimes supplemented with hares, which are quite abundant, but not very relishable. The houses are constructed of wood covered with clay, and, as a rule, consist of only one room, in which the people and animals live together. The upper and wealthier class are better provided with lodging and food. As a race they are exceedingly courteous and very hospitable, and they are excessively punctilious concerning points of honor, such as the proper place at table and at festivals.

AN IMPROVED WINDOW-SASH-LIFT.

The sash-lift pictured in the engraving is designed to be attached to a sash in order to facilitate the opening and closing of the window. The device can be readily applied and is designed to prevent the accidental breaking of the glass by the slipping of the hook or pole used for raising and lowering the window.



GREEN'S WINDOW-SASH-LIFT.

Of the accompanying illustrations, Fig. 1 is a perspective view showing the device attached to a sash. Fig. 2 is a central cross section of the lift.

The device comprises a plate or shield which is attached to the top rail of a sash. This shield has an outwardly extended flange engaging the upper surface of the sash rail. On this flange a stop is formed in the form of a staple or loop, serving the dual purpose of preventing the hook or pole used from slipping and striking against the glass of the upper sash, and of offering a means for attaching a cord by which the sash may be raised when it is not desired to use a hook. Extending inwardly from the upper end of the plate or shield is a ledge having its under surface downwardly and inwardly inclined. This ledge is designed to be engaged by a pole or hook for the purpose of raising the sash, the inclined under surface preventing the hook from sliding outwardly; by providing the plate or shield with brackets, the raising instrument is prevented from sliding laterally. Around the upper inner edge of the ledge is an upwardly extended flange designed to be engaged by a hook or pole for the purpose of lowering the sash. Extending outwardly from the plate or shield is a stop in the form of a staple or loop which, like the first mentioned stop, serves the purpose of preventing the hook or pole from slipping and of offering a means for attaching a cord for the purpose of lowering the sash. This window-sash lift is adapted for use in factories and shops where obstacles such as work benches are usually placed near the window, rendering access to the sashes difficult. Since under these circumstances workmen usually employ a rod or pole to open a window, a device like the one described would lessen the danger of breaking the glass.

The attachment described is the invention of William H. Green, 323 Fulton Street, Elizabeth, N. J.

Another New Element—"Xenon."

At the meeting of the British Association, which was held this year at Bristol, England, it was announced that on September 8, Prof. Ramsay and Mr. Travers had discovered another elemental gas which they called "xenon." It is found to possess a spectrum analogous to that of argon, but the position of the lines differs materially. It seems to only exist in minute quantities.

A REMARKABLE STAGE ROAD.

BY C. F. HOLDER.

Among the developments of the Southern Californian region during the past few years, the island of Santa Catalina has occupied a prominent position, from its location and natural beauties, being the popular resort of the people of this section. Ten years ago there were but one or two houses on the island; to-day there is a good sized village, Avalon, on the bay of that name, which has a large modern hotel with smaller ones and cottages by the score.

AVALON BAY AND VILLAGE, SANTA CATALINA ISLAND, CALIFORNIA.

This growth is due to several reasons. The island possesses great natural beauties, and its proximity to Los Angeles, being but three and a half hours by boat and rail from this progressive city of 115,000 inhabitants, has been a factor in its development. Santa Catalina lies about twenty-five miles off the coast of Los Angeles County, and constitutes one of the southernmost of the chain of islands reaching down from Point Conception and ending with San Clemente. The island is twenty-two miles in length, and is an off-shore spur of the Coast Range, a range of mountains lifted out of the water, presenting the appearance of an emerald in a setting of azure in winter, when the rains have changed everything to a rich green. The island mountains run parallel to the greatest length, and in the center have an elevation of 2,500 or 3,000 feet in several peaks, as Mt. Banning, Orizaba, and Black Jack, which can be plainly seen from the Sierra Madres, many miles distant, constituting the peaks included in the United States Signal Service in their work of signaling up the coast.

The conformation of the island is singular and different from that of the East, owing to the powerful rains, resulting in cutting up the island into a maze of cañons, which are in turn branched and bifurcated to such an extent that the surface is everywhere scored, level tracts being confined mainly to the large cañons. These cañons dominate everything; their mouths constitute the only beaches and approaches, as originally the island had abrupt cliffs which breasted the sea, but in ages the rains in rushing down from the interior have cut deep cañons and branches which have become filled with verdure. The sea has ground up the rock and formed beaches, and in this way the east and south slopes have been supplied with shallow bays and coves, each being the mouth of a cañon and bearing a stream either at the surface or beneath the sand, after the fashion of many California rivers.

The island lies in the great Japanese current, and Avalon has a climate which varies little winter and summer. As an example of its singular features, at the present writing, May 27, the thermometer at 2 P. M. and 10 P. M. shows the same, or 60°. The summer days are almost always delightful, the winter the time of flowers. Having such conditions, Santa Catalina has deservedly acquired a reputation as a health and pleasure resort; and, being also remarkable for its game fishes, people have come here from all over the country. For many years the upper and almost inaccessible interior was reached by narrow trails which tested the nerves of the tourist. The interior island had good hunting, a different climate, and so many natural attractions that the owners of Santa Catalina decided to build a stage road from one end of the island to the other. This has been nearly accomplished, giving a fine roadway, which, owing to the remarkable difficulties in the way, is one of the most interesting pieces of construction in the Western country. The proposition was to build a ten per cent grade road fifteen feet in width up and over a series of five deep cañons and along their precipitous sides to the summit of the island, then across in a northwest direction to Little Harbor on the south and west, eleven miles, and from there in a northerly direction eight miles to what is known as the isthmus. The average observer, contemplating the steep cañons which lie about Avalon, would have pronounced this road impossible, yet the result has shown the reverse, and one of the most picturesque and attractive stage roads in the country has been opened up.

Avalon lies on a perfect crescent shaped bay, the natural mouth of Grand Cañon, which extends across the island at the south end, almost cutting it in two, a lofty ridge being the barrier and breaking the prevailing winds. The coach road begins on the north side of the entrance to this cañon, passing over what was once the site of a populous native town. It leads up from Avalon, then takes a sharp turn, and skirts the edge of Grand Cañon, running out to the point, then turning abruptly and beginning the ascent of Descanso Cañon. The road is a ten per cent grade, and from here was cut on the face of what was much of the way a steep, precipitous cliff, the slope being so steep that a rock would roll rapidly to the bottom, hundreds of feet. Descanso Cañon is winding and filled with verdure, and the view charming and attractive; the eye resting now on the upper range in rich grays against the sky, now on the river of green winding below, or, as the coach and six turns, on the blue ocean that extends away thirty miles to the mainland, where, thirty or forty miles further, loom the snow-capped Sierra Madres.

Following the face of this cañon, the road gives several fine horseshoe curves, which afford the whip ample opportunity to display his skill in six-in-hand driving. For a mile or two the road gradually rises up Descanso, the coach seemingly in the air or suspended over the trees of the cañon bed; now it is on the bare and rocky face of the cliff; now reaching the head of the cañon, it dives into a low forest of wild lilac, greasewood and others, turning again to descend with a rush, facing the sea. So precipitous are the sides of the cañon and so sharp the turns, that several loops have been brought into play, the coach and six turning on itself, without which it would be impossible to continue, owing to the sharp point of the mountain spur. At these loops the coach seems moving out into space over an airy cape that terminates abruptly; but once up to it, the road is seen to turn gracefully, forming a half figure eight, the coach crossing its own tracks and entering the third cañon.

The road now runs parallel to the sea awhile, then following the third spur, turns and apparently runs down to the ocean. But this spur is soon surmounted and the turn into another cañon made; and thus turning and climbing, and by the aid of three ingeniously constructed loops, the coach reaches the summit of the island at this portion, standing apparently directly over the water, 1,500 feet above it. From here a magnificent panorama is displayed, and the entire contour of this portion of the island seen. From the coach one looks down upon the coast, with its green slopes, its white, sandy bays and beaches, and, most striking of all, Grand Cañon with its maze of cañons, well illus-

NEW STAGE ROAD OVER THE MOUNTAINS, SANTA CATALINA ISLAND, CALIFORNIA.

trating the undoing of mountains and the making of cañons in California.

This has been the most difficult part of the road, and it may be of interest to note, in passing, some of the items of construction. The route was selected and the grade established after much difficulty, many problems presenting themselves, but the eleven miles already completed from Avalon to Eagle Camp was built in five months, with a gang of from thirty to fifty men and twenty-eight horses, at an expense of about $20,000. As stated, the grade is ten per cent, and about 140,000 yards of material were removed, in which eight tons of powder were employed in blasting the rock from the mountain side. In reaching the summit five cañons were crossed, or rather passed, without the aid of a bridge, all the curves and natural indentations being followed—a feature which adds much to the attractiveness of the drive.

From the summit the road extends for a long distance parallel with the front ridge of the island, affording the observer a constantly changing view of cañons which enter the sea north of Avalon and south of Long Point—a high cape. Not far from the natural base of one of the highest peaks is the widest portion of the island—about 8 miles. Here the longest cañon begins, winding down, first as a narrow gulch, gradually widening out into a flat level plain, encompassed by the peaks, Mount Banning, Orizaba, and Black Jack, and the ridges about them.

An interesting feature of this drive is that it passes several ancient town sites where the aborigines lived, the heaps of abalones at the mouths of the cañons telling the story. North of Black Jack is an ancient olla manufactory, where the natives made their stone mortars, which they sent to the mainland for exchange. On the fronting ridge the writer found evidences of an arrow manufactory—bits of broken arrows, flint, and heads in various stages of completion.

Once in Middle Ranch Cañon, the six-in-hand gallop along the fine level roadway, finally reaching Eagle Nest Camp beneath a group of sycamores, which constitutes the terminus of this section of the road at present. From this point the road has been surveyed to Little Harbor, and owing to the amount of rock to be blasted, it will be the most difficult portion to build. Little Harbor has its inn, and from here to the Isthmus, eight miles, the road is completed, rising to the divide, above the Isthmus, where there was a large Indian village, then pitching down suddenly, with many fine curves around various cañons, ending on the sandy beach, giving the traveler nineteen miles of staging and five of horseback riding, assuming that he has taken the entire trip.

There are several famous stage roads in California, but it is safe to say that none exceed this in novelty, by which the coacher is treated to a constantly changing panorama of mountains and ocean in a climate which will make this island one of the great sanitariums of the world.

Machinists' Nomenclature.

There are, perhaps, few except those who have had much translating of technical literature from English into foreign languages, who have any idea of how many absolutely meaningless names we have drawn from the animal kingdom, and which very seldom can be rendered in their technical sense by their actual equivalent.

Thus the machinist employs a *dog* on his lathe; he takes a *hog* cut, if the tool will stand it; the castings are made from *pigs* of iron, which in turn were fed from a *sow*. Work is set upon a *horse* or *buck*, and punched or bent by a convenient *bear;* screws are turned by a *monkey* wrench.* Hoisting is done by a *crab*, and a convenient *cat* is a part of the outfit of a shop *crane*, and a *kit* of tools is ever at hand. A *crow* helps to straighten work, a *jack* to lift it, a *mule* pulley aids in driving machinery that a *donkey* engine turns. A *fish* connects parts end to end, or strengthens a broken beam; *shells* are used all over; a *worm* does powerful but quiet work. A *cock* shuts off the water; one kind of a *ram* raises it and another does heavy work. A printing press has a *fly;* the first locomotives had a *grasshopper* valve motion and drive, and *butterfly* valves are common. *Herring-bone* gears are used by the best builders; *turtles* fit printing press cylinders, and *fly*-wheels are running all over the world. In drilling, even an *old man* is called into service, and *doctors* prevent faulty lathe work.

But from the human body itself we borrow the name of nearly every principal part, as head, neck, and chest; arm, leg, and toe; heel, sole, and foot; elbow, shoulder, wrist, and knee; knuckle and finger; rib and diaphragm; eye, ear, nose, and cheek; mouth, tongue, and tooth; throat and gullet; back, side, and belly.

From the minor animals also we get snout and horn, tail and claw, wing and feather, quill and spur, fin and scale.

Exasperating to foreigners learning our technical terms.—R. Grimshaw.

* This, however, got its name from the inventor, Thomas Monkey, of Bordentown, N. J.

Science Notes.

Van Ermenglin states that the toxic ptomaines sometimes found in preserved meats, hams, game pies, etc., are due to the presence of a specific organism, Bacillus bolulinus. The soluble toxine it secretes, called boluline by the author, is stated to be so intensely toxic that one thousandth part of a milligramme killed a rabbit in twenty-four hours. Fortunately, this ptomaine is destroyed at a temperature of 60° to 70° C., and the bacillus which produces it at 85° C., so that thorough cooking will remove all dangers in the case of salted or smoked meats.—Journ. de Pharm. [6], ix., 88.

Prof. A. Gray has been devoting a considerable part of his time to determining the circumstances which affect the conductivity and specific conductive capacity of glass. From manufacturers in London and Jena various specimens of glass were obtained. These were all richer in lead and freer from soda than glasses formerly available. Specimens of glass used for thermometers, and a barium crown glass, were tested also. It was sought to ascertain whether by increasing the lead-oxide and diminishing the amount of soda, the conductivity would go on diminishing. The resistance was taken after five minutes' electrification. The "Jena glass" showed considerable effects of dielectric polarization. Powell's glass did the same. The barium glass showed hardly any, but it had a very high resistance, and behaved like lead and lime glasses. The Jena glass had low resistance, from its high percentage of soda and complex composition.

The medical officer of one of the leading deaf and dumb institutions of England states that he has obtained material aid from the seemingly improbable source of a loud-speaking telephone in the treatment of his patients, in the education of such deaf mutes as possess a fragment of hearing power, the telephone being found to possess many important advantages over the speaking tube usually employed. In the first place, in arranging for this purpose, the wires from several receivers can be coupled up to one transmitter, and thus a teacher can instruct a group of children at the same time; then again, it is not necessary for a teacher to apply his mouth close to the transmitter, so that pupils have a full view of the facial expressions and lip movement, which is not possible when having to direct his voice into the mouthpiece of a speaking tube or trumpet. While seeing the movement of the lips, the patient has the sound conveyed close to his ear drum—a most advantageous combination.

The idea of utilizing the threads of the spider on a larger scale than is, or was, done by telescope makers is very old, but attempts have never been persevered in. About ten years ago a Madagascar missionary, Camboué, experimented with two kinds of spiders of that country. He seemed to be successful, but nothing further has been heard of his researches. In the professional schools at Chalais-Meudon, we see from the Industrie Textile, spiders have now to spin for the benefit of the balloons which are used for scientific and military researches. The spiders are grouped in dozens before a reel, which withdraws the delicate threads. One spider can give a thread from 20 yards to 40 yards in length, after which performance it is released. The threads are of a pinkish hue, and are washed to remove the sticky surface layer. Eight threads have to be combined. The resulting texture is much lighter than ordinary silk of the same bulk, and strong cords for military balloons can no doubt be obtained in this way.

After numerous practical experiments, it has been found by Ferdinand Linneborn, of Hagen, Germany, that a fabric may be produced for garments which shall have properties adapted to keeping the skin cool and thus obviating excessive perspiration. Wool and cotton-wool have the property of absorbing moisture, but wool deprived of oil has it in a considerably greater degree; but in order to prevent clogging of the pores by the fluff, the new fabric is woven or knit with that surface which comes in direct contact with the skin with linen and wool fiber. The linen threads, which come in contact with the skin and are possessed of little power of absorption, are well dried at 100 degrees Celsius, then steeped in a solution of ten parts of paraffine and one hundred parts of benzine, remaining thus from four to five hours at a medium temperature, and when taken out are completely dried at 100 degrees Celsius, after dripping; the yarn so obtained does not absorb any perspiration. The wool remains in a bath of 40 degrees Celsius and consisting of one hundred liters of water, six of spirits of sal ammoniac, one and three-quarters pounds of soap, and two pounds of soda for four hours. It is then well stretched, rinsed in clear running water, and dried at 100 degrees Celsius; while still warm, the wool is now placed in a bath of 40 degrees Celsius and composed of five parts of spirits of sal ammoniac and three of benzine, each skein being now stretched under strong pressure for three minutes, again rinsed in running water, and dried. These threads are woven or knit into a fabric having one side entirely of linen threads or yarn and the other entirely of woolen.

Correspondence.

Speed of the Bicycle.

To the Editor of the SCIENTIFIC AMERICAN:

On page 151 of the SCIENTIFIC AMERICAN for September 3, there is an interesting rule for determining the rate of speed of a bicycle. We think a still simpler one is the following, as it enables the rider after he has found the number of seconds for his own wheel, to ever afterward determine his rate of speed without any further calculations.

Rule.—Multiply the gear by 10 and divide by 56. Call the result seconds. The number of complete revolutions made by either pedal in that number of seconds shows the rate of miles per hour. Example.—If your gear is 84, then $84 \times 10 \div 56 = 15$; and if either pedal makes 20 revolutions in 15 seconds, you are riding at the rate of 20 miles to the hour. If the gear is 67·2, then $67{\cdot}2 \times 10 \div 56 = 12$, and 20 revolutions made in 12 seconds equals 20 miles to the hour.

JOSEPH DIXON CRUCIBLE COMPANY.

The Uranium Intensifier.

Uranium has long been known as a first-rate intensifier with many advantages over the poisonous mercury. It is so simple and gives such good results.

But the usual one solution intensifiers, generally used, have the serious drawback of rapidly deteriorating, and becoming useless, which has no doubt considerably restricted their employment.

The plan I have adopted, however, completely overcomes this difficulty, and the intensifier prepared on the following lines will keep well.

The method is to make up two separate stock solutions, which are mixed as directed, when required for use. The mixed intensifier is then of precisely similar strength, etc., as the "single solution" ones.

Stock Solution No. 1.

Potassium ferricyanide (red prussiate)	100 grains.
Boiled water	5 ounces.
Glacial acetic acid	5 "

Stock Solution No. 2.

Uranium nitrate	100 grains.
Boiled water	10 ounces.

To prepare the intensifier, take 1 ounce No. 1 and add 8 ounces water, then add 1 ounce No. 2, which quantity will intensify several half-plates, and is best thrown away after use.

The negative may be immersed either dry or wet, but it must be free from hypo, also it is essential to keep the dish rocking.

When sufficiently intensified, wash until greasy appearance of plate disappears, which is about twenty minutes; too long washing is injurious.

If from any cause the intensification is unsatisfactory, it can be entirely removed in a few minutes by soaking in a solution of soda carbide 2 ounces, water 1 pint, and well washing.

This property also easily admits of local reduction. It has also the advantage of being capable of being used as a reducer. Intensify first, then immerse in hypo 1 ounce, water 6 ounces, ammonia 1 drachm. This acts rapidly, and the greater the original intensification, the greater will be the eventual reduction.—J. R. R. in Photo. News.

Comparative Census of European Countries.

According to figures given by the latest number of La Revue Française de l'Etranger, the total population of Europe, by calculations made on the latest census, is 380,000,000, which is a gain of 37,000,000 over that computed January, 1888. Here is a table showing the figures given in the Revue Française de l'Etranger:

Europe and Russia and Finland	106,200,000
Germany	52,300,000
Austria-Hungary	43,500,000
The United Kingdom	39,800,000
France	38,500,000
Italy	31,300,000
Spain	18,000,000
Belgium	6,500,000
Turkey in Europe	5,900,000
Roumania	5,600,000
Portugal	5,000,000
Sweden	5,000,000
Holland	4,000,000
Bulgaria	3,000,000
Switzerland	3,000,000
Greece	2,400,000
Denmark	2,300,000
Servia	2,300,000
Norway	2,000,000

The density of the population according to each square kilometer (about 0·386 square mile) is thus reckoned: In Belgium, 220; Italy, 169; Holland, 149; England, 126; Germany, 97; Switzerland, 73; France, 72; Austria, 69; Spain, 36; Russia, 20. While the annual increase of the population of Russia has been 1·45 for every 100 in the last ten years, that of Germany has been 1·15, of Austria-Hungary 0·96, of England 0·35, of Italy 0·45, of France 0·08. At this rate of augmentation, in 100 years, Russia would have 228,000,000 inhabitants, Germany 106,000,000, Austra 79,000,000, England 65,000,000, Italy 44,000,000, and France only 40,000,000.

Oceanic Phosphorescences.

Nature dazzles the eye of man with many wonderful phenomena, but perhaps never more so than when she turns the gloomy night waters of the sea into a sheet of silvery fire. At these times every movement of the wave, every cleavage of the water by oar or prow, reveals in its dark depths a hidden fire which scintillates and sparkles with weird and mysterious light. The spectacle is one of absolute fascination, for the Spirit of Enchantment rests upon the waters and reality becomes fairyland. The ancients, keenly alive to a sense of the supernatural, saw in this luminosity a manifestation of some unknown power, and wondered; the ignorant read in it a portent of judgment and terror; while in all ages the curious and the searchers after knowledge have speculated as to its cause. But just as nature has invested its appearance with a halo of mystery, so she has also wrapt in much obscurity its immediate cause; and thus, though in the course of centuries varying suggestions have been put forward, nothing with any finality about it has been arrived at. It was asserted truly that certain fishes were luminous; sharks have glowed and shone, shoals of herrings, pilchards, or mackerel have been moving masses of light, and the fish drawn out of the water have lain in great shining heaps, the glow of which vanished as they dried and died. Many writers have described the passages of ships through such shoals—the sheet of moving flames—the beautiful pale greenish elf light that the fish exhibited; while poets have apostrophized the "mimic fires of ocean" and the "lightnings of the wave," and scientists and naturalists have in turn tried to account for their power of luminosity. Some have attributed it to the presence of certain substances of a fatty nature excreted by the fish and adhering to the surface of their bodies; others have declared that it is due to a subtle power of the fish itself—a form in which the energy of life shows itself under certain conditions, just as this energy may be exhibited in heat, or motion, or electricity; others, again, have ascribed it to direct absorption and transmission of the light of the sun, and so on. Many theories have been elaborated, but none convincingly. But now, it is asserted, the secret is laid bare. It is wonderful how many secrets the searching light of the nineteenth century is claiming to reveal. It is, perhaps, a matter for still more wonder whether in the far future our descendants will indorse all our solutions, or whether they will not smile at some of them just as we, half contemptuously, discredit those of our ancestors. However that may be, we have, in this case, a solution offered to us that apparently approaches nearer the heart of truth than any yet put forward, in that it satisfies the various phases of the phenomenon and gives a unity and coherence to its manifestations. It is only lately that any very serious effort has been made to study this phenomenon, but the research has been abundantly rewarded, for it is now pretty certain that the luminosity is due to the presence in the water of various kinds of bacteria.

Now, bacteria are the very smallest living organisms of which we have cognizance. Millions of them can lie on a penny; therefore, to produce the gleaming appearance recognized by us as phosphorescence, they must be present in numbers too enormous even to contemplate with our finite minds. It would be immeasurably easier to reckon with the stars for multitude than with these phosphorescent bacteria. They are colorless, rodlike bodies, only known to us in the land revealed by the highest powers of the microscope, and careful comparison shows minor differences among them. For instance, some of them are capable of independent motion—we can hardly call it swimming—others are non-motile, some are inclosed in a jelly-like covering. Others are without this sheath. Their power of motion is probably due to excessively fine hairs at their extremities, which, moving to and fro in the water, act the part of oars. These cilia have not been found in all forms of bacteria which move, but their presence is inferred, since every advance in the study of motile forms increases the number of bacteria which are seen to possess them. These light-producing bacteria are known as photo-bacteria, and so far some half-dozen varieties have been distinguished and named. That they lie at the bottom of the matter—that phosphorescence is due to their presence—has been and can be proved in several rather pretty ways. It is not sufficient, of course, that we should always detect them in any examination of luminous sea water; to prove that they are the cause of light, we must be able to procure luminosity by introducing them into water that did not previously show this quality, and this can be done thus: Place a few of these tiny organisms into sea-water or broth prepared from fish, and keep at a suitable temperature; they can then be cultivated without much difficulty, and as they spread and develop phosphorescence appears, so that a removal of the vessel into another room shows unmistakably the glow of the familiar light. It only appears, however, at the surface of the liquid, where the oxygen of the air has free access to the bacteria; if, for experiment's sake, the supply of fresh air be cut off—that is, if no oxygen be allowed to come near them—then the little colony of bacteria loses its fascinating power and remains dull and shorn of its glory. But restore the air, and the microbes again recover their normal condition and luminosity seems a natural corollary. There is a tale told that a lady, whose husband made bacteria his study, took a leaf out of his book, and cultivated these bacteria on gelatine in such a way that as they developed they shone out the message, "Hommage à M. Pasteur." The shining letters were then photographed and the picture sent to the great bacteriologist, thus conveying in graceful form the warm appreciation in which he was held by those following in his steps.—Knowledge.

AN OPENING AND CLOSING DEVICE FOR FIRE-BOXES.

Considerable difficulty is often experienced in starting fires in locomotive and other furnaces, owing to the reduction in temperature produced by the entrance of cold air to the fire-box. An invention recently patented by M. J. Griffin, general yard master, and P. W. Hogan, car foreman of the Grand Trunk Railway at Island Pond, Vt., is designed to overcome this obstacle.

The invention as illustrated in the engraving consists in providing the fire-box with two doors sliding on guideways secured to the front of the fire-box. Projecting pins on the doors engage the slotted ends of levers fulcrumed on the lower guideway and connected pivotally at their lower ends by links, with the upper end of a bar sliding in a guideway secured to the front of the fire-box. This bar extends below the platform in front of the fire-box and is rigidly connected, as shown, with the lower end of a spring-pressed foot-piece extending above the platform in convenient reach of the fireman's foot.

Normally the spring of the foot-piece, acting through the medium of the bar, keeps the doors of the fire-box

GRIFFIN AND HOGAN'S OPENING AND CLOSING DEVICE FOR FIRE-BOXES.

tightly closed. When the fireman desires to shovel coal into the fire-box, he presses down the foot-piece in the manner shown, and moves the bar downwardly, thus causing the links to act on their respective levers to slide the doors outwardly in the guideways. After having thrown in his coal, the fireman removes his foot, this causing the doors to close automatically. It is evident that the doors during this process are open but a short time, so that cold air is prevented as much as possible from passing into the fire-box and reducing the temperature while firing up.

Protection of a Closet Trap.

F. P. Dunnington writes us from the University of Virginia as follows:

In cold weather, not unfrequently there is necessity for leaving the trap of a closet unused in a location where it cannot be warmed, when, if the water standing in it is frozen, the trap might be destroyed, or, if the water be removed, sewer-gas would escape. This difficulty may be overcome by putting into the trap about one pound of common salt. This salt will saturate three pints of water, which is approximately the volume required to fill a closet trap, and this solution will not be frozen at any temperature above zero. Repeated stirring will be required to get the salt dissolved.

In hot weather, in an unoccupied house there is danger of water evaporating from a closet trap, so as to "break the seal" and allow the escape of sewer-gas. This result may be prevented by putting into the trap about one-half pound of dried commercial calcium chloride (costing a few cents). This salt has so great an affinity for water that it will hold on to it even through the greatest heat of the summer, and it is not corrosive or poisonous.

In some degree calcium chloride acts like common salt in preventing freezing, but for this purpose common salt is most efficient.

Miscellaneous Notes and Receipts.

Uninflammable Celluloid.—According to Asselot, dissolve 25 parts ordinary celluloidine in 250 parts acetone and add a solution of 50 grammes of magnesium chloride in 150 grammes of alcohol until a paste results, which occurs with a proportion of about 100 parts of the former solution to 20 parts of the latter solution. This paste is carefully mixed and worked through, then dried, and gives an absolutely incombustible material.—Chemische Industrie.

Petroleum as Fuel.—To the endless number of recipes for the production of petroleum briquettes may be added the following: Petroleum, 10 liters; resin, 1 liter (?); soap powder, 1·5 kilos.; caustic soda, 3·3 kilos.; sawdust, 3 liters; and sand are heated with constant stirring. After ten minutes the mass begins to solidify. If liquid is still present, add soda. The mass thus obtained is formed into briquettes and cooled. Their heating value is said to be three times as great as that of coal briquettes.—Kraft und Licht.

Production of Stamping Ink for Linen.—Moisten 10 grammes of powdered dragon's blood resin and 10 grammes of powdered silver nitrate –lapis infernalis—throughout with a few drops of distilled water and increase the mixture by 10 grammes of white dextrine and enough glycerine so as to give the mass the consistency of a good printing ink. The rubber stamps employed should be rubbed before use with a few drops of sweet almond oil. Spread the ink on pieces of velvet for transferring purposes.—Färben Zeitung.

Antacid Shoe Polish.—A shoe polish which is free from acid is offered for sale under the name of "Antacid Glanzlack." The recipe for its production is as follows: Filter 50 grammes of powdered gall nuts, 30 grammes of logwood and 200 grammes of water; after boiling for two hours, dissolve in the hot liquid 200 grammes of sirup and 30 grammes of green vitriol. The fluid is boiled until it commences to thicken, then add a solution of 10 grammes of ruby shellac in 200 grammes of alcohol, stir the whole well together and fill the finished dressing in bottles.—Fundgrube.

Easy Removal of Boiler Scale.—In the Bull. de la Société d'Encour. the interesting observation is reported that boiler scale is rendered quite loose and is for the most part washed away on emptying out the water, if the latter is allowed to cool off slowly after taking the boiler out of use, which requires a varying length of time according to the size of the boiler, but generally eight to ten days. The remainder adhering to the walls can be removed by a strong jet of water. Where boilers can be kept idle for so long a time, this method is of great convenience, especially for boilers with narrow pipes or parts of difficult accessibility.—Der Seifenfabrikant.

Gum Arabic.—The gluing agents which are found in commerce under the name of gum arabic consist only for the smallest part of genuine Arabian gum, and we mostly receive in their stead substitutes containing dextrine; partly also gum resins resembling gum arabic; for instance, the gum exuding profusely from the Flinderria maculosa, indigenous in Australia. The fact that the powdered gum is frequently adulterated with entirely worthless substances, such as pulverized cherry pits, also deserves mention. Rock sugar mixed with milk and soda waterglass is likewise sold, in lumps and powder form, as gum arabic. Such a surrogate anybody may prepare at home by very finely powdering 3 parts (by weight) of rock candy and dissolving by boiling in one part (by weight) of fresh cow's milk, which must not be skimmed. To the boiling solution add 7 parts (by weight) of soda waterglass of 33° to 36° Be. Cause a thorough mixture by stirring, allow the whole to cool off to 36° to 38° Reaumur (=115° to 118° F.), pour out on a tin plate with upturned edges, allow to harden and knock with a hammer on the back of the tin, whereby the gluing material separates in grains.—Maler Zeitung.

Preservative Composition for Furniture, Wooden Ware, etc.—A composition for the preservation of furniture and woodwork, etc., has been patented in France by the Société Allegre and Goillot, says a Continental exchange (Maler Zeitung). This composition is said to possess the peculiarity of imparting to the articles upon which it is used not only the desired gloss, but also the appearance and the brilliant color of perfectly new articles. This distinguishes it from other preparations used for like purposes. The coating leaves no visible layer after the application. The mass is composed of: 10 parts pale rosin, 82 parts benzine, 5 parts palm oil, ½ part mirbane essence, and 1½ parts essence of peppermint. The mixture is prepared by the cold process and the application is as follows: Apply a little of the composition on the furniture, floors, etc., by rubbing with an old soft silk rag and finish wiping at once with a dry silk rag, pressing down well, whereby an incomparable luster is said to be produced. The objects remain in this glossy condition one to two months, according to the amount of dust developing in the respective rooms, and are then again treated with the composition. The product must be kept hermetically closed up. If used in summer, it is well to add a few drops of oil.

THE CIVILIZED INDIANS OF THE PHILIPPINES.

BY PROF. J. B. STEERE.

The chief factors in the future of the Philippines are the civilized Indians. The best Spanish authorities estimate their numbers at over six millions. Europeans, other than Spanish soldiers, number less than ten thousand. Nearly two hundred thousand mestizos —people of mixed blood, Spanish and Indian, and Chinese and Indian—are affiliated closely with the Indians and are their natural leaders.

The civilized Indians are rapidly increasing in numbers. At the coming of the Spaniards in 1519, they were supposed to number about half a million. In 1735, more than two hundred years later, they were estimated at a million. In 1800 they had increased to two millions. These estimates, though doubtless far from correct, show that their ratio of increase has rapidly accelerated during the present century.

Among the various reasons for this rapid increase of population in recent years, the cessation of the bloody raids of the Moros of Mindanao and Sulu is, no doubt, one of the chief. For over two centuries and a half these people had made frequent expeditions, in their swift vessels, along the coasts of the eastern and central islands as far as Mindoro, and even in some cases to the bay of Manila, burning towns, carrying off plunder, and killing or carrying away into slavery the Christian inhabitants. When pursued by the Spanish war vessels, they would either outsail them and escape, or, if this was impracticable, they would get out their oars and pull away in the eye of the wind until they were out of reach of the guns. The introduction of steam gunboats by the Spanish has put an end to these piratical expeditions.

STREET SCENE, PANEPANGA, ISLAND OF LUZON.

We found marks of the rapid growth of population in nearly all the islands visited, in the formation of new plantations and villages. This was especially noticeable in Negros, Mindoro, and Mindanoa.

The Philippine Indians are much like the civilized people of Java and Celebes in appearance. They are brown in color, with coarse, straight, black hair, and little or no beard. Many of them show a decided Chinese obliquity of the eyes. They are larger and stronger than the people of purer Malay type to the south. Their physical appearance, as well as their language, shows their close relationship to the savage tribes still existing in the islands.

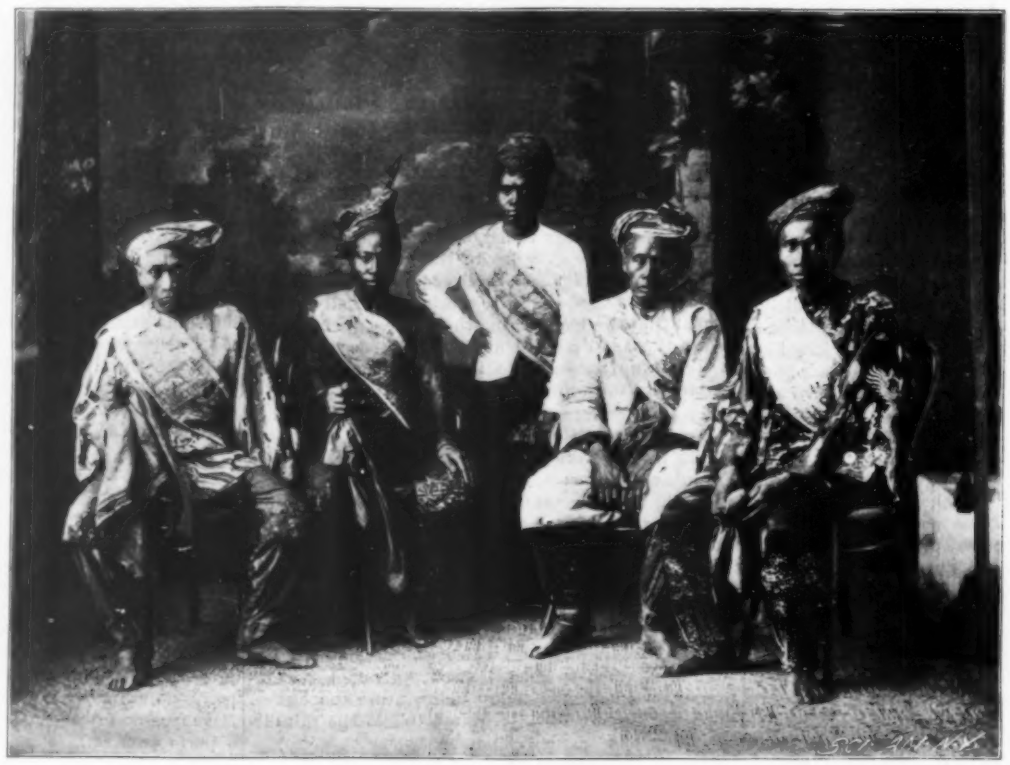
Their language shows a large admixture of Malay words. The best Spanish authorities consider them mixed races of Malay and Negrito stock, with perhaps some infusion of Chinese and Japanese blood.

Their origin and relationship to the Malay race is a part of the great race problem of the Pacific.

They are separated by their languages or idioms into several tribes. The chief of these are the Tagalos, inhabiting Manila and central Luzon, and numbering about a million and a half, and the Visayas, numbering over two millions and occupying the central and eastern islands. Some five other idioms are spoken by from two to three hundred thousand people each. These tribes are not only alike in having adopted the Christian religion, but are so similar in appearance and dress and customs that the casual visitor cannot separate them. The Tagalos are considered the superior race. The differences of language naturally give rise to more or less jealousy and mistrust, which will probably have considerable influence on the future development of the islands.

There existed at the coming of the Spaniards a written language among the Tagalos and the Visayas, with an alphabet, said by some to be of Arabic origin and by others to be unlike any other. The native languages are now written and printed in the Roman letters.

The Philippine Indian is simple in his necessities and his tastes. His clothing consists of shirt and short trousers, the shirt being invariably worn outside the trousers. He usually goes barefooted, but wears on his head when in the woods and fields the salacot, a round bowl-shaped black hat, made of narrow strips of some fine species of rattan. This is of several thicknesses and is impervious to rain, and serves passably well in case of need as a helmet or a dish to hold water or food. The women wear a short loose jacket or camisa and the saya, a piece of cloth wound round the hips and the corner tucked in at the waist to secure it. The woman's hat is made of palm leaf or rattan, but with a broad brim, so that it serves as an umbrella in case of need. I have seen two women sheltering themselves under one hat as they crossed the street in the rain. The hat also serves as a basket, and in the market the women display their fruits or flowers or fish upon it, placed on the ground before them. The Indian governors of the towns and their council of principal men, when they attend church together or on other state occasions, wear short coats of black broadcloth over their shirts, which still hang over the trousers below, and crowd their feet into shoes of European make. Many of the Indian women of Manila wear low slippers on their bare feet. These are too narrow for the whole foot, and the little toe is left to travel in the mud outside.



MALAY CHIEFS, MINDANAO.

The house of the Philippine native is as simple as his clothing. Tall posts of some durable timber are planted firmly in the ground, and to these, six or eight feet above the earth, are lashed or framed the floor sills of the house. The walls are of palm leaf tied to upright timbers with rattan. The roof is also of palm leaves, thick enough to be stormproof. The floor is usually of split bamboo, with open cracks which allow the dirt to fall through. Openings are left in the walls for windows and a door, and these are closed against storm by shutters of the same materials as the walls. The fire place is ordinarily a box filled with earth upon which the fire is built, the smoke making its way out through the thatch. The furniture consists of a few earthen pots for cooking, joints of bamboo for holding water, and raised platforms of bamboo, which serve for tables and chairs and beds. It seems strange that large towns of houses of such inflammable material, placed thickly along narrow streets and with open fireplaces in each, should exist any length of time without burning up. I once asked an Indian of Zanebranga what prevented the city from burning up, and he answered that it must be the mercy of God.

This method of building houses perched above ground is more or less common among all the races with Malay relationship, and may have grown out of the habit of the Malays of building over the water. It seems to have no significance in the Philippines, but simply to be the universal fashion.

The food of the Philippines is chiefly rice and fish, eaten without knives and forks, or chopsticks, with the fingers. The national dish is tuba, palm beer, made by cutting off the points of the great flower stems of the cocoanut palms, and collecting the sweet juice which flows from the wounds. Bamboo cups are hung in the trees to collect the juice, and long bamboo poles are laid from the crown of one palm to another, so that the tuba gathered may pass from one tree to another, without descending to the ground. These roadways, frequently sixty or seventy feet above ground, look like great spiders' webs, and need the skill of a rope walker to use them. The juice rapidly ferments, and is colored and made bitter with the bark of mangrove roots.

In common with the Malays and Javanese, the Philippine islanders make much use of buyo, betel nut. The pieces of nut are wrapped in pepper leaf, and smeared with lime before chewing. They are not such excessive tobacco users as the Malays and Chinese, and what they use is smoked in long home-made cigars or in cigarettes.

The men are addicted to cock fighting. The government prohibits this except on feast days and Sundays, and in the regularly licensed cock pits, of which each town has one. The pairing of the cocks forms quite a share of the labors of the Indian, and a most common sight in a Philippine town is two neighbors squatted on their heels in some quiet corner of the street, each holding a cock by the tail, and allowing them to spring and strike at each other, and then drawing them back. They bet heavily on their favorite fowls. I have seen an Indian take up his dying bird which had lived just long enough to win the match, and with tears in his eyes and voice carry it tenderly away, while another, whose bird had turned tail, picked it up and carried it off while cursing it, and tearing great handfuls of feathers from its cowardly skin.

They have learned games of cards of the Spanish, but do not seem addicted to gambling as their masters. In Manila they invest much of their earnings in the lotteries.

They are all good Catholics, and make much of the feasts and services of the church, and there can be no doubt that the church has been the chief civilizing

agency among them, and, on the whole, has been an immense power of good. The territory occupied by them is divided into nearly a thousand parishes, the priests of which are in most cases monks of the various orders of Augustines, Dominicans, Franciscans, and Jesuits, the Augustine monks and Dominicans being the most numerous.

In many towns the priest is the only white man, and though he may be a poor unlearned Spanish peasant, he becomes the chief man of the community, and the progress of the town and surrounding country depends upon him. He is the sole architect of the church and convents, and shows the natives how to build streets and bridges, and, for lack of any other, he may take the place of the schoolmaster.

The Indians seem to have little desire for learning, a large proportion of those who strive after more than the merest rudiments of an education being mestizos, many of whom make their way to Manila and enter the schools and colleges there. About twelve per cent of the population are able to read, nine per cent can read and write, two and one-half per cent speak Spanish, while about eight per cent, according to the expressive Spanish statistics, "no saben nada," don't know anything.

They love music and learn it readily. Their musical instruments are borrowed from the Spanish. This is also true of many of their dances, one of the most common of which is the fandango. This frequently takes the form of a contest between the dancers, not only of skill and endurance in the dance, but of wit and repartee in the singing which always accompanies it. While present at a feast and the accompanying dance at the little village of Madsin, in the interior of Panay, a young Augustine priest was kind enough to translate for me the singing, which was in Visayas. The young Indian, barefooted and dressed in white pants and embroidered shirt, began by exclaiming, "My eyes are astonished! From whence has come down to earth such beauty?" The girl who had been quietly dancing opposite, and listening, now answered, "The youth is bold and his mouth is full of flattery, and of such as the maidens may well beware." Putting on a look to represent the passion he was supposed to feel, the young fellow sang, "If I could win this beauty, I should be happy, but if she refuses me, I shall die." The girl, apparently relenting, responded, while she covered her face with her hands and blushed through her dark skin, "The words of the youth are full of passion, but I do not wish his death. Let him ask my father. If he is willing, I will not refuse him." The Indian, who had been listening with rapt attention, now started back and exclaimed, "My love has vanished. I have discovered that the beauty has a turned-up nose." This was too much for the girl to stand, especially in the presence of us Costillas, white men, and she ran away and hid herself among her mates, who filled one corner of the room.

The methods and implements of the agriculture of the Philippines seem to be borrowed from the Chinese. The lower lands along the streams are carefully leveled and fitted with dikes and ditches for irrigation, so that they may be planted with rice. A one-handled wooden plow is used in turning the soil. The plow beasts are carabaos, buffaloes, a single one of which is hitched to the plow by a rude collar and traces. The rice is planted in hills by hand. It is thrashed by being tramped out with the bare feet. It is stored in the hull, and usually pounded out in rude mortars by the women and boys as it is needed for use, the pounded rice and hulls being separated by being thrown into the air upon broad trays of woven rattan.

Rude mills turned by buffaloes are used in some places for hulling rice for market. In addition to this lowland rice, much timber is being continually cut off and mountain rice planted. This method has been carried on so continuously in many places that the coarse, grass has taken the place of the timber, and open plains or campos have been formed. This grass, cogon, is too thick and strong to be turned by the rude plows in use, and immense portions of the country have thus become useless except for pasture.

The buffalo is also used for riding and for transporting rice and sugar and timber upon huge two-wheeled carts, which are frequently roofed with palm thatch or woven bamboo for protection against rain. Horses are abundant in many of the islands, but are rarely used in agriculture. They are small and hardy and make good saddle beasts. The Indians never think of feeding them, but ride them as long as they wish and then turn them loose upon the plains. Fowls are kept by many of the people, and swine by a few.

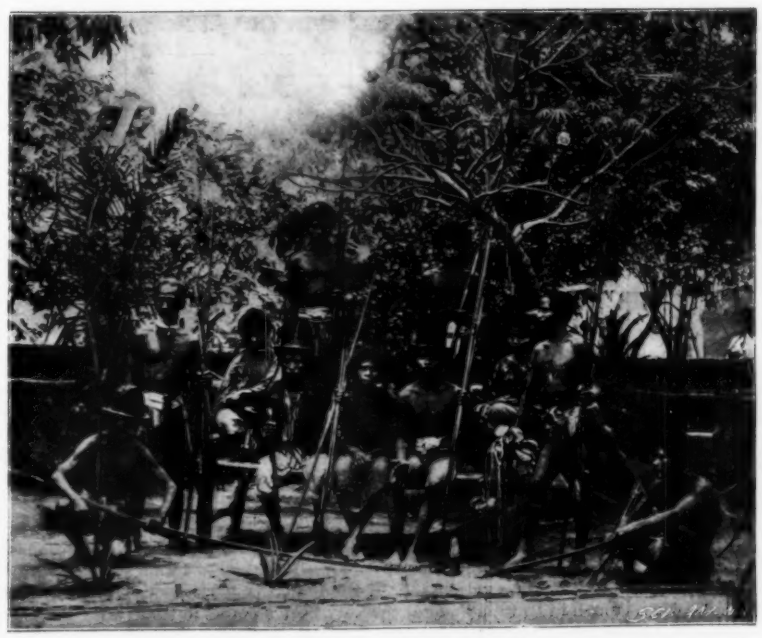
VISAYAS WOMEN WEAVING.

Each family has its fruit garden, frequently surrounding the house, in which are found bananas, cocoanuts, betel nut palms, custard apples, mangoes, and other fruits. In the ravines and on the mountain sides are planted patches of the banana producing the Manila hemp, abaca. The sugar and coffee of the islands are chiefly the product of foreign capital and enterprise.

The Indians make good hunters, killing great numbers of deer and wild swine with their dogs and lances. They also collect wild honey and gums and rattan and timber from the woods. They are good sailors and fishermen. Their boats are of the Malay type, long and narrow, with outriggers on both sides. They carry large sails, and the sailors keep them from capsizing by crawling out upon the outriggers and thus balancing the boats. They fish with cast nets and seines and also extensive fish pens and weirs.

There is considerable trade and intercourse kept up between the various islands by the larger native boats.

The women aid in the care of the fields and sometimes in the fishing. In the central islands they show great skill in weaving, using silk imported from China and the fiber of pineapple to mix with the native cotton and the finer kinds of abaca. The goods made are especially fitted to the climate, being light and almost transparent, so that the air and sunlight readily pass through them. Our engravings are made from photographs taken in the Philippine Islands.



NEGRITOS OF MARIVALES—THE CHIEF AND HEAD MEN WITH HATS PRESENTED BY THE SPANISH.

Films for Photography.

Mr. W. J. Stillman, the critic, writes to The London Times: The importance of photography for scientific expeditions has become so great that I believe the account of a crucial experiment I have just concluded, to test the value of films of celluloid as a substitute for glass, may be of interest to the scientific world. Having been requested to organize the photographic section of the first African expedition led in 1893 by the late Captain Bottego, who was so barbarously killed last year on his second journey into the regions of the Upper Nile, I decided to provide the official photographer only with celluloid films, but of two kinds—the roll of flexible film, used in the kodak, and the cut thick "films," which practically are employed as glass. The former, as is now well known, have limited lives, and my chief dependence was on the latter, which are shavings about the fourth of a millimeter in thickness from a solid block of celluloid, flexible, practically not breakable, and lying flat in the holder like glass. The results, considering the inexperience of the operator, who learned the process while we were waiting for the supply of material, and the difficulties of the climate, water, etc., were most satisfactory; but, with a view to exhaustive testing of the capacities of the material, I kept by me several packets of the same consignment of films, and tested them from time to time. Of one of these packets in my possession in Rome ever since, and coated, as I learned from the manufacturer, in June, 1892, I have just exposed and developed four on a most difficult subject, and produced four perfect negatives as good in every respect as if they had been made five years ago. Lieutenant Citerni, the photographer of the second and luckless expedition, which I also fitted out with the same material, informs me that the films worked perfectly up to the capture of the party by the Abyssinians, two years after setting out, and that they developed without injury at a temperature of 30° Centigrade, the lowest their nights gave them. But as the development might be effected a year or more after exposure and at home, the advantage is not limited to this.

Considering the extreme portability and infrangibility of these films and their inestimable superiority in these respects over glass, and in other respects over paper, I think that these experiments have a high value for scientific voyagers, to whom photographic illustration is so important, and the difficulties of photographic operation en voyage are so great. A priori, as the celluloid is produced under the action of strong acids, and has a certain tendency to liberate the acids with time, their action tending to cause insensibility in the haloid which holds the photographic image, I believe that in so long a time as is covered by my experiment they would have become quite insensible, but I did not see that in this respect there was much falling off.

A little there probably is, for in the case of films of the highest sensibility I have found that impressibility for all practical purposes had disappeared after a year, those of lower sensibility losing less in proportion; but this is of absolutely no moment, exposure in the camera for a second more or less being a matter of no importance. The fact that a traveler may with this portable and unbreakable material spend years in the most difficult explorations with photographic record possible at all stages, and develop it on his return home, ought to be of scientific import.

Electricity on War Vessels.

Technical reports which have been received at the Navy Department indicate that the electrical appliances on our warships have worked successfully during action. This has been particularly pleasing to the naval constructors, who have found that the use of electricity in the operation of the turrets, steering gear and windlasses was satisfactory. The opposition to this plan from the conservative element in the department has been so strong that the new battleships for which bids have just been opened will be equipped with electrical turrets only.

The Educational Value of Machine Work.

In machine shop work for manual training the influence of the highly efficient instruction in the technical schools has been strongly felt. Our manual training methods have been, in many cases, better suited to the technical school than to manual training.

There is a very widespread idea that, since the machine shop deals with machine tools, there can be no great mental effort involved. This view is erroneous; intense mental effort may be called for by a properly arranged course.

The basis of a machine shop course should be the mental condition of the pupil rather than varied and extensive uses of the machines. This gives a good reason for the manual training differing from the technical course. A critical examination of machinery is rich in educational advantage. Our pupils are rushed too soon into the technique of the work.

The economical use of the students' time and energy is all important. Hand work, being comparatively slow and uneconomical, should form but the connecting link between the hand work in wood and the machine work in metal. The hand responds promptly to detailed direction of the mind; if the hand does not attain the desired result, the trouble is with the mind, not the hand.

There is a degree of accuracy called commercial accuracy, which it is perfectly practicable to maintain, but which can only be exceeded by incurring disproportionate expense. Interchangeable parts of machinery have the errors confined to such narrow limits that the variations cause no trouble with the machine as a whole.

In manual training we sometimes ask for the highest attainable accuracy, rather than the lesser, practical accuracy.

Machine shop work assimilates readily the teachings of other branches, and can be made to form a good connecting link between the matter studied from books and the material surroundings. The mere doing is not without its value, but, after all, it is the teacher working with the shop as his tool that makes the most lasting and beneficial impression on the boy.—Abstract of paper read July 12 before the American Manual Training Association, at Washington, D. C., by C. P. Binns, of the Teachers' College.

Commercial Emery.

Available practical information, other than elementary, on the above mineral is conspicuous by its absence from all the mining and chemical works I have been able to consult. Merchants who buy and manufacturers who work up the stone into emery wheels and emery cloth, to say nothing of the knife polishes, pastes, and powders, seem to be, one and all, more or less completely in the dark, and they buy and pay high prices, comparatively, for stone of inferior quality, while they refuse to give their attention to stone which is, from a practical and analytical point of view, of superior value.

"A rose by any other name does *not* smell as sweet," and the consequence is that names of mines which have long been exhausted are given to new ones whose product, in some cases, does not represent half the value of their reputation.

The complete analysis of emery stone is a tedious and expensive process, and perhaps, as a rule, very accurate estimations of its composition are not needed. There are, however, a few practical and easy ways of testing its comparative value which I propose to place before your readers, so that they may have, if they like, something more to go upon than a name, however well known it may be, and some better guarantee of quality than that supplied by the price paid per ton.

It goes without saying, of course, that the value of an emery stone depends upon its abrasive power, the amount of work it will do on glass, steel, etc., before reduction to an impalpable powder which has no longer any cutting action. This abrasive power depends almost entirely upon the percentage of anhydrous oxide of alumina contained in the mineral. Some, perhaps most, of the best emeries carry also a small percentage of titanates, but as the amount of theser arely exceeds five per cent, they may be left out of consideration. The principal impurities in emery consist of salts of lime and iron.

We have, therefore, roughly in emery stone:

1. Oxide of alumina (anhydrous).
2. Titanate of iron.
3. Limestone.
4. Oxides of iron.

Numbers one and two are insoluble in strong acids, while numbers three and four are soluble. Hence it is an easy matter to get rid of the latter, and so estimate the percentage of alumina and titanate the stone contains.

First Experiment.—Take one gramme of finely granulated emery, and heat gently over a small spirit lamp, in a small glass beaker, with ten grammes of aqua regia, for ten minutes, with frequent agitation. At the end of this time carefully pour off the acid liquid, which will have become more or less highly colored. Now add to the residue in the beaker other ten grammes of acid, and set aside in a warm place for two hours, now and again gently agitating. At the expiration of two hours pour off the acid, and carefully wash the residue several times with water. Drain, put in a warm place to dry thoroughly, and weigh the residue.

The loss in weight represents the soluble and valueless material and the weight of the residue represents its percentage of abrasive value.

Second Experiment (Magnetic Loss).—Take one gramme of finely powdered and sifted emery, place on a sheet of white paper, and draw through the powder a small horseshoe magnet. With most emeries, it will be found that the two poles of the magnet become covered by adherent particles of magnetic oxide of iron. After passing the magnet through the powder, raise it a little, and lightly tap it, so that any particles may fall which are not firmly adherent. Now wipe off carefully the adherent magnetic oxide on to another piece of paper, and again pass the magnet through the emery powder, again remove adherent particles, and repeat the process until the magnet comes away from the emery quite clean. Now weigh this clean residue.

The loss in weight represents the magnetic iron oxide, valueless as an abrasive.

Third Experiment (Abrasive Power).—Take a small glass mortar with glass pestle. Carefully and exactly weigh the pestle. Now place in the mortar one gramme of fine granular emery, add a very little water—two or three grammes—and proceed to triturate the emery with a regular pressure and motion as long as the least grittiness or bite on the glass can be felt. As soon as it is found that there is no more "bite," wash clean and thoroughly dry the pestle and again weigh it. Its loss in weight will represent the relative abrasive power of the emery under examination.

The time occupied in this experiment will vary considerably and in exact relation with the value of the stone for grinding purposes. The end of the operation is very distinct and well marked, and two or three trials of different emeries will render any intelligent man capable of performing the experiment.

Precautions.—1. Every test of abrasive power must be made with the same pestle and mortar, to avoid possible variations in the hardness and texture of the glass.

2. Every test must be made on emery granulated by sieving to the same degree of fineness.

In this way every manufacturer is a law unto himself, for the reason pointed out in precaution number one, and variations in the quality of different shipments can be recognized with the utmost facility.

At the beginning of these experiments I had the idea that the specific gravity of the stone might perhaps give indications of its quality, but in actual practice I find this character is quite unreliable. As will be seen by the table printed in this paper, one of the worst Asia Minor stones has almost exactly the same gravity as one of the finest, and the variation between it and the well known Naxos is very small.

No.	Abrasive Power.	Loss with Acids.	Magnetic Loss.	Specific Gravity.
		Per cent.	Per cent.	
1	100·00	25	..	3·92
2	82·80	18	..	4·08
3	80·00	25	15	4·10
4	76·30	12	9	3·85
5	69·00	17	13	3·95
6	40·60	38	4	3·85
7	37·50	..	39	4·07
8	31·25	15	30	4·33
9	25·00	..	..	3·89
10	17·34	25	2	3·78

From the above table, it will be noticed that the difference between the best and the worst emery examined is the difference between 100 and 17½. Yet, as a matter of fact, the difference in the prices at which these emeries are sold is the difference between £3 10s. and £3 only, and this is a typical example of the influence of a name, and the astounding ignorance of manufacturers of the chemical composition of the raw material they are using.

It is a difficult matter to give a description of good emery which shall be of use to users of it, other than the semi-chemical ones herein explained. But, on the spot, in Asia Minor, a man who is accustomed to the handling of large quantities of stone from different mines can tell unerringly by its fresh fracture whether the stone is good, bad, or indifferent. It varies very much in "grain," one of the very best emeries in Asia Minor being very coarse grained and another of equally good character being fine grained. The difference being caused probably by the ordinary chemical law, slow cooling yielding large crystals and rapid cooling small crystals. This is more or less proved by the fact that, up to a certain point, the deeper you get in an emery mine, the larger and the more regular the crystallization becomes.

To judge of a stone by its outward appearance is very misleading. Chip a piece of the emery and take it into a good light, not direct sunlight. It should show a perfect regularity in the size of its crystals, an absence of spots of all sorts, and be of a clean gray. The grains of alumina will seem to stand out from the surface and will lend a sort of transparency to the stone. Bad stone, when examined in the same way, will show holes, patches of red, spots of white, and especially a flat, glassy form of crystal. Some specimens contain mica, and this renders the stone almost valueless and quite unsalable. Mica will be found in most emery mines, but it is generally between the slabs of stone and sometimes adherent, not in the emery itself.

In places where denudation has exposed emery to the action of the rain and air, decomposition has occurred, with the production of a reddish clay. This is particularly the case in one or two large mines in the neighborhood of Kuluk. This decomposition goes on to a less extent in all emery mines which allow of the percolation of water and access of air. In other instances, where an impermeable covering of limestone has prevented the infiltration of water, the emery comes out white on the outside, and as by far the larger demand is for red-coated emery, it has led to the artificial coloring of the white and gray stone. This sort of falsification may easily be ascertained by washing with water. Stone which has been doctored gives up its coloring at once. Naturally red-coated stone is reddish even when the clay has been scrubbed off. Manufacturers may, with the tests given in this paper, demonstrate the quality of the stone they are supplied with, and would be perfectly justified in refusing any which does not come up to the standard they desire; and having the means to protect themselves, they only are to blame if, in the future, they are misled by bogus names or are swindled by commission agents who do not know the difference between emery and ironstone.

FRANK R. BULLAND.

Big Fortunes from Little Inventions.

It has become almost an axiom with the majority that larger fortunes are to be raised from some simple invention than from difficult and expensive inventions that involve a great outlay of money to manufacture. This is to a certain extent true. A certain American patent for fastening kid gloves has yielded a fortune of several hundred thousand dollars for its fortunate owner, and the inventor of a collar clasp enjoys $20,000 royalty a year as the reward for his endeavor. A new kind of sleeve button has made $50,000 in five years for its patentee, and the simple twisting of safety pins in such a way that there is no possible danger of the point sticking in the child promises to enrich its owner beyond any of his early dreams of wealth. A man one day turned a piece of wire so as to hold a cork more securely in a bottle, and forthwith somebody saw a brilliant idea, and patented the modern wire stopple-holder, which is now used annually on several million bottles. The accidental bending of a hairpin by a woman to prevent it from sliding out of her hair also easily produced a fortune for her husband, who immediately saw the possibilities of a crinkled hairpin for women.

Instances could be multiplied indefinitely of large fortunes being made from small inventions; but fortunately for those inventors who make a life study of intricate problems of mechanics, and disdain to waste their talents upon trivial, popular articles of the day, there is often also ample reward held in store for the products that take years to produce, and which revolutionize existing methods of industry and mechanics. Edison has reaped honors and riches of a princely character from his discoveries; McCormick has realized in his reaper the fortune of a millionaire; the Corliss engine brought honors and decorations to its inventor, and enabled him to amass a great fortune in a few years; Prof. Bell found in his telephone not only the consummation of his early hopes and ambitions, but a substantial pecuniary reward; Harveyized steel armor has become synonymous with the inventor's name, and it brings an annual income of huge proportions to its discoverer; Elias Howe, the inventor of the sewing-machine, realized over $2,000,000 from his inventions; and Nikola Tesla, though still young and rich in promises, finds an abundance of money in his work.—George Ethelbert Walsh in Cassier's Magazine.

New Coaling Stations.

The Naval Board detailed to examine sites for coaling stations have now made their report. The Board visited various points along the coast from Maine to Port Royal, S. C., and made recommendations of suitable places for these stations, of which there are destined to be a large number, with the steady increase in the navy. One of the great lessons which the war has taught has been the lack of means of coaling war vessels along our coasts, and it was not until the war broke out that coaling stations were established at Dry Tortugas and Key West. Since this time a contract has been let for a station at New London, Conn. None of the new stations which are contemplated will be elaborately equipped, and the cost of each is likely to be from $100,000 to $200,000, according to location and importance. The storage capacity of each will be from 5,000 to 20,000 tons.

Reclaiming Sterile Land in Germany.

The value of agricultural land in the consular district of Mannheim, Germany, is unusually high, says Consul Hoffman. The holdings per capita are small, and owners are consequently compelled to plant remunerative crops, reserving only sufficient ground for the cultivation of food products and forage for cattle. An interesting illustration in the attempt to retain, or even increase, the arable surface is at present to be observed two miles east of the city.

The valley of the Rhine is about 20 miles across at this point, the lower or river terrace consisting of agricultural lands exceedingly rich in loam and old river deposits, while two miles east of the river the second terrace rises to a height of about 40 feet, most of which consists entirely of fine sand, covered at various places by a thin film of loam and now used for the training of pines. Passing through several miles of artificial forest, one emerges to find better soil and ordinary farm lands used for raising wheat, oats, potatoes, and carrots.

The removal of the edge of the above-mentioned sand terrace was begun early in the spring, the material being transported by cars over a temporary track. The sand is removed by means of specially constructed dredges, and at this time of writing about 6 acres have been exposed, reducing the surface to the level of the farm lands on the lower or river terrace. The top crust of loam has been carefully removed from the sand terrace and carried down to the newly exposed surface of sterile river gravel to form new acreage, being there distributed and having a depth of about 6 or 8 inches. Over a great portion of this new surface young cabbage plants are growing, and other crops will be started as rapidly as the loam is deposited and leveled.

This illustration is but one of many showing rigid economy among these hard-working inhabitants.

THE SURPRISE PEN.

Our engraving shows a very clever trick pen which would tend to create great surprise among the uninitiated. Let us suppose that a gentleman is seated at his desk and is busily writing when a neighbor comes in and he jokingly challenges the latter to try and forge his signature. He hands the pen to his friend, who attempts to write. Immediately there is an explosion and the paper receives a big ink blot. The writer is apt to be surprised by the report, which is like a pistol shot, and if a timid person, is apt to be frightened. The noise comes from the pen itself, as it is so constructed that it can be loaded and shot off at will. The person in the secret can handle the pen with safety, but the poor unfortunate will experience a rather unexpected shock to his nerves when he attempts to write with it.

The upper part of the penholder, into which an ordinary writing pen is thrust, works on a pivot about half way down its length. This separate part is provided with only one-half a bottom, in order that it may engage the conical head of a piston rod which ends in a plunger which sets off the cap secured in the bottom of the penholder. The normal position of the plunger is against the cap of the holder, but it can be raised by means of a projecting pin riveted to the rod and passing through a slot cut in the side of the lower part of the holder. Now the closed half of the bottom of the pivoted end enters a notch caused by the conical head of the plunger, and the plunger with its spring is cocked, as it were, by means of the projecting pin, and is held in place by the bottom of the pivoted section. When the pen is pressed to the paper the pivoted section swings on the pivot, releasing the plunger, which is forced down on the explosive cap by the spring.

The lower end of the penholder is threaded, so that it can secure the end cap firmly in place. The explosive cap is put in the end cap, and it is screwed on the bottom of the holder. Ordinary paper caps for children's pistols are used. As long as the plunger simply rests on the cap there is no danger of an explosion, but just before the joker wishes to give his friend a scare, he cocks it by pushing the plunger up with the pin, until the pivoted top engages it.

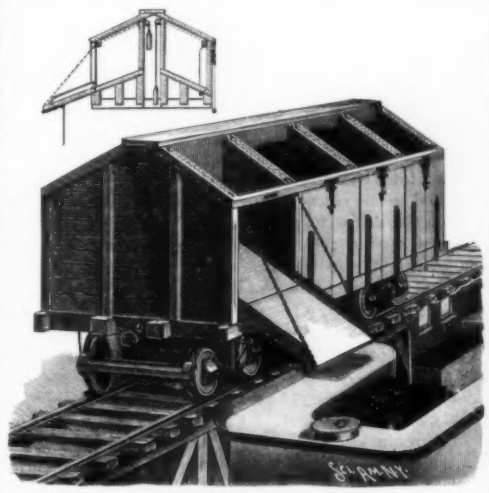
THE SURPRISE PEN.

Toning Muddy Platinotypes.

Workers in platinotype find to their cost that damp paper, or paper printed without proper precautions in damp weather, gives dirty-looking, muddy prints. These, however, may be recovered, and gain a splendid blue-black tone if spread over with glycerine, and a little gold solution be poured on, to be rapidly and evenly incorporated with the glycerine with the aid of a swab of cotton-wool. The change in tone is rapid and marvelous, and a wash to free from the auriferous glycerine completes the process.—M. E. M. D. in Photo. News.

A NEW WAY OF COALING LOCOMOTIVE-TENDERS.

At regular intervals along their lines, the various railway companies have established coaling stations for their locomotives, to which stations coal is conveyed in cars and unloaded. When coaling an engine at these stations large iron buckets are loaded by hand, hoisted by a crane and then lowered into the tender. The expense and labor incurred in this process



AN IMPROVED COAL CAR.

are considerable, and the coal itself is often wasted by this repeated handling. It is the purpose of an invention recently patented by M. J. Griffin, General Yard-Master, and W. P. Hogan, Car-Foreman of the Grand Trunk Railway at Island Pond, Vt., to overcome these difficulties.

The invention in question consists in dividing a car into a series of pockets having sloping bottoms discharging toward the outer sides of the car. These pockets are closed by doors or chutes which can be raised or lowered, and used to discharge the coal into the locomotive-tender. The partitions forming the pockets are made double, with a space between the parts to receive the sides of the doors or chutes. When closed, the doors are locked in place, each by a catch comprising a slide held in engagement with a staple by means of a spring. A rope attached to the lower part of the slide permits the doors to be readily unlocked. The doors are raised and lowered by ropes carried over pulleys through the space in the double partitions, and up on the under side of the foot-board. Counterweights are attached to the ropes, and move vertically in a longitudinal well or chamber, as indicated in the cross section. In using the car an elevated track is provided, running parallel with that occupied by the locomotive. When the engineer desires to replenish his coal supply, he runs alongside of the elevated track with the tender of his engine beneath one of the pockets in the car. The catch of the door or chute being then released by pulling upon the rope, the door falls and the contents of the pocket are discharged into the tender. Locomotives can in this manner be coaled from both sides of the elevated track without causing any delay and without incurring any great expense.

Trade on the West African Coast.

The methods of trading on the west coast of Africa have changed very little in the last fifty years, says The New York Sun. There is much improvement in communication with civilized countries, but the natives themselves are the same old "heathens who in their blindness bow down to wood and stone." The climate has a great deal to do with this, and the always hot and malarious country makes great activity impossible. It is only when we read of possible international complications, caused by the traders of one European country encroaching upon the ceded rights of another, that we find that the trade is worth fighting for. This is notably the fact just now on the Upper Niger, where the French traders and the English representatives of the chartered Royal Niger Company have differences to settle. The French traders used formerly to confine their attention to their own settlements in Senegal and other minor places, and for some years they have had a railroad in operation in the region of the Gambia River, but lately their merchants have been more progressive and are vying with England and Germany for prestige in numerous coast ports. There is now telegraphic communication right down to the Gold Coast, and it promises to be continued down the west and southwest coasts until it reaches Cape Colony and forms a belt connection with the telegraph up the east coast of Africa.

From the old days when Liverpool and Bristol vessels indulged in slave trading as a side issue until quite recently, smart brigs and schooners would go out to the coast with a cargo of merchandise, and the captain would be both trader and navigator. He would visit a number of small places and barter his cargo on board his own ship for palm oil and small quantities of ivory, gold dust, and other native produce. Often the voyage would occupy a year or more, and each vessel would take, besides her crew, coopers and mechanics to assist in the loading. It is said that often a cask of salt, which might be worth $5, has been exchanged for a cask of palm oil worth $150; but that was long ago.

The trade has long ceased to be so lucrative, and though business is still conducted by bartering spirits, tobacco, cotton goods, and a thousand and one other things for produce, it is very rarely that a vessel will trade on her own account. There are several lines of mail steamers that go down the coast from European ports, and the merchants have trading stations or "factories" ashore where they receive merchandise from the mail boats, and dispose of it for produce which they prepare for home shipment. On the northwest coast, in the region of the Gambia River, ground nuts —in reality our peanuts—are cultivated and shipped from the principal port, Bathurst, to Europe, and are there crushed and a valuable oil extracted.

Going south, the next port of importance is Monrovia, the capital of the little republic of Liberia, called often the American colony. Further south again comes Sierra Leone, a large town, and civilized in comparison with many other places; in fact, it is compulsory to wear clothes on its streets. The Sherbro River is hereabout, with its numerous trading stations, and from this vicinity large quantities of palm oil and palm kernels are shipped.

Again going south, or rather east, at this point, one comes to Lagos and the Gold Coast, with Cape Coast Castle and Accra as important military stations. From this district a quantity of gold and ivory is received, and in many places rubber and small quantities of cotton. Further down still, the ports of Bonny and Akassa, at the mouth of the great Niger, are deyots where large hulks are anchored to receive merchandise and produce, either from or to the branch steamers that run up the great river. An enormous trade in palm oil is done up the Niger.

As one goes south, Gaboon, another French settlement, is an important point, and here and further south still rubber is taken in large quantities and shipped to Europe, where it vies in quality with the fine South American products. The Congo River is becoming very productive, and down in this part of the coast the climate is much more endurable; in fact, if you go still further south to the Portuguese settlement of St. Paul de Loanda, the country is healthier and the climate good. Lately the merchants are trying to cultivate cotton and jute, and the latter takes very kindly to the soil, and promises to rival the best qualities of the East Indies. Palm oil is not so valuable as it used to be, the low price of cottonseed oil and tallow affecting it very considerably. It is used principally in the manufacture of soap and candles.

IT takes thirty-seven specially constructed and equipped steamers to keep the submarine telegraph cables of the world in repair.

Artificial Vanillin and Vanilla Flavors.

Recently considerable excitement was aroused in Vienna, Austria, by the fact that a number of seemingly most mysterious cases of poisoning—and not a few fatalities—were traced to the use of ices and confections purportedly flavored with vanilla. But why the vanilla alone should be at fault is pertinent query, since this was the verdict brought about by the investigation.

That the vanilla bean is in a measure toxic, if ingested in large quantities, no one familiar with this growth will deny; but any amount that could induce an untoward effect must, necessarily, be so great that it could not, by any possibility, be embodied in gallons of ices or a hundredweight of confections. Again, though the bean produces a malady in those handling it known as the "vanilla disease"—a form of skin eruption that, while it may be communicated to others, is necessarily self-limited—this can have nothing to do with poisoning by vanilla "flavors," since its source is a minute insect, the "vanilla louse," of the same precise class as the cheese mite, and its period of life is extremely brief when transferred to the integument of human beings.

Also worthy of being recalled is the fact, admitted even by those most interested in their production, that vanilla "flavors," vanilla "extracts," vanilla "essences" and "tinctures," such as are employed solely to promote *soveur* or piquancy, are never absolutely pure; on the contrary, for the most part, they are made with tonka bean alone, or with tonka to which from five to twenty per cent of vanilla bean is added. The high prices the latter command, and which oftentimes are actually prohibitory, are cited as an excuse for the deception; further, it is added, the mixture secures a better flavor, one preferred for domestic, culinary, and confectionery purposes. In this connection it may be remarked that while so-called "fruit flavors," employed in kitchens, confectionery establishments, bake shops, and at soda fountains, are almost invariably derived from butyric ether—a product of rancidity—this accusation does not hold good as regards vanilla preparations.

But even tonka beans are at times expensive, and recently they, as well as vanilla, have been replaced, in the manufacture of flavors, by vanillin. This latter is the active principle of both vanilla and tonka beans, but if had from this source, would manifestly serve to still further increase the cost of "extract" production. It has been had also from coal tar by process of synthesis, but this again was held insufficiently economical, or it was feared the knowledge that a flavor owed its origin to an anilin factory would militate against it as a marketable product. Now vanillin is purportedly derived from the inner rind of the bark of certain pine and fir trees, by the aid of sulphuric acid and either sodium or potassium chromate, the process being somewhat intricate, secret, and legally protected. It is likewise (and perhaps more commonly, certainly more economically) had from oleaginous, gummy, and balsamic substances that are possessed of an aromatic, stereoptin constituent known as cardol; and it is the latter upon which the burden of reproach is supposed to rest—a supposition that does not appear to be well founded.

Cardol is certainly highly toxic; so is hydrocyanic (prussic) acid, to which our most delicious fruits owe their flavor. Cardol is found, but only in infinitesimal quantities, in most forms of vegetable growth, the only fruit yielding it in fairly tangible proportions being the "elephant louse" (Anacardium orientale) of the far East; and while it is highly poisonous when injected into the circulation, and most irritating when applied to the skin, producing a painful burning eruption, attended with considerable swelling and infiltration of serum (cellulitis), it is known to be inactive when taken into the stomach, being insoluble in any of the digestive secretions. Manifestly, then, cardol cannot be deemed a factor in vanilla poisoning, unless it can be shown: First, that it is present in artificial vanillin in appreciable quantities; second, that in the manufacture of vanillin certain chemical transformations result whereby a cardol combination of free and ready solubility is had.

The remarkable part of the Vienna investigation lies in the fact that no evidence is offered to show that the constituents of the ices and confections other than the vanilla flavoring were investigated. Considering the number of fatalities, an examination for developed and contained ptomaines, or for anilin coloring matters, would seem to have been demanded. At the same time, more knowledge regarding artificial vanillin is desirable.

The Scientific American in Colorado.

The following entirely unsolicited criticism of the work achieved by the SCIENTIFIC AMERICAN during the war recently appeared in the Daily Chieftain, of Pueblo, Col., and we feel sure that our readers will bear with our pardonable pride and that they may be interested in reading the notice:

"It is singular but true that the SCIENTIFIC AMERICAN, a paper which might be supposed to be devoted to musty and tiresome compilations of scientific lore, has throughout the Spanish war contained the most accurate and interesting illustrated war sketches, especially those pictures presenting naval vessels and their structure. The war ended, the SCIENTIFIC AMERICAN this week presents elaborate illustrations of that great Western triumph of peace and progress, the Omaha Exposition. Provincial and narrow the New York dailies may be, but the SCIENTIFIC AMERICAN is always progressive, not only metropolitan, but cosmopolitan."

The Current Supplement,

No. 1185, contains a number of articles of general interest. "A Day in the Chief Fire 'Watch' of Berlin" is an illustrated article showing the various types of fire companies, practice houses, practice towers, etc. "Central Station Statistics" gives valuable and authoritative figures as to central electric lighting stations in the United States owned and operated by private corporations, individuals, and municipalities. "General Blanco, the Governor-General of Cuba," is a subject of a biographical note accompanied by a large portrait. "American Competition from an English Standpoint" is another article on the subject from our English contemporary, The Engineer. "Some Forms of Filariæ" is an article by Dr. G. Archie Stockwell and is an interesting study in natural history. "Glacial Geology in America," by Herman L. Fairchild, is concluded. "The Cultivation of Saffron" is an illustrated paper on this industry. "A Hunting Expedition in the Altai Mountains" describes an interesting excursion of two Germans in a little known region. "The Development of Pure Food Legislation" is an important address by W. D. Bigelow, the retiring president of the Chemical Society of Washington, D. C.

Contents.

(Illustrated articles are marked with an asterisk.)

African coast, trade on the west 187
Bicycle frame, the 178
Bicycle, speed of the 182
Books, new 189
Camp Thomas, the water supply at 178
Census of European countries, comparative 182
Closet trap, protection of a 183
Coaling stations, new 186
Coaling tenders* 187
Coldest country in the world, the 180
Current SUPPLEMENT, the 188
Emery, commercial 186
Fire boxes, an opening and closing device for* 183
Gate, a novel self closing* 180
Geology at the meeting of the American Association for the Advancement of Science 179
Indians of the Philippines, the civilized* 184
Inventions, recently patented 188
Little inventions, big fortunes from 186
Locomotive tenders, a new way of coaling* 187
Machine work, the educational value of 186
Nomenclature, machinists' 182
Notes and queries 189
Notes and receipts, miscellaneous 183
Pern, the surprise* 187
Philippine Islands, the* 177, 184
Phosphorescences, oceanic 183
Photography, films for 185
Platinotypes, toning muddy 187
Raft of piles on the Pacific, a great* 180
Sash-lift, an improved* 180
Science notes 182
SCIENTIFIC AMERICAN in Colorado, the 188
Stage road, a remarkable* 184
Sterile land in Germany, reclaiming 187
Uranium intensifier, the 182
Vanillin and vanilla flavors, artificial 188
War vessels, electricity on 185
Water supply at Camp Thomas 178
Wind bracing in frame buildings 178
"Xenon," another new element 180

RECENTLY PATENTED INVENTIONS.

Mechanical Contrivances.

AN APPARATUS FOR EXAMINING THE EXACT SPHERICAL FORM OF BALLS.—HEINRICH MELTZER, Ratibor, Germany. This is an apparatus by which to detect inaccuracies in the spherical form of steel balls, and it is based on the principle that truly spherical bodies, placed on a true inclined plane, will roll in an undeviating path. In carrying out the invention, a narrow incline plane, of true formation, is provided, and the balls to be tested are liberated at its top in regular succession, and in a line longitudinal with the plane. The true balls will roll throughout the length of the plane, while the untrue balls will, in deviating, roll off the edges of the plane. It is thus that the test is effected.

PROPELLER.—CARL J. H. FLINDT, New York city. This invention relates to propeller wheels for steam vessels, and its object is to provide a propeller wheel so constructed that its friction against the water during rotation will be reduced to a minimum, so that greater speed will be secured. It consists of two propeller blades attached to the shaft, and crossing each other at right angles, the blades being extended in straight lines from the shaft outward and having their fore and aft edges forward and rearward of their connection with the shaft, the width of the blades being greater than the height and the extreme stern ends being curved toward the shaft.

STRAP OR ROPE CLAMP AND TIGHTENER.—AARON GRANT THAYER, Kensington, Kan. This new invention provides a simple and durable clamp for ropes or straps. In brief, it consists of a clamp comprising a frame having guide bars, a ring and cross bar for the admission of a rope or strap, and a slidable cross bar on the guide bars, and arranged to operate in conjunction with the ring and cross bar to securely clamp the end of the strap or rope in place.

SCREW-JACK HEAD.—DANIEL GLENN, Del Rio, Texas. This invention provides a locking device for screw-jack heads, so that the parts cannot separate, the locking mechanism being used as a brake to prevent the jack from moving backward. It consists of a screw-jack having a threaded shaft terminating at one end in a peripherally grooved head, a bearing head recessed to fit over said head and having an internally opening groove in the wall of said recess adapted to register with the groove in the shaft head, locking blocks fitting the grooves and holding the two parts together, the groove in the bearing head being of a depth to entirely receive the blocks, and set screws in the bearing head and engaging the locking blocks.

BALL-BEARING SCREW-JACK.—DANIEL GLENN, Del Rio, Texas. This invention consists in the peculiar shape of the thread of a screw-jack by which the thrust surfaces upon the shaft and nut are substantially at right angles to the direction of the thrust, also in the stop mechanism, which will prevent the backward rotation of the jack and which can readily be released at will. Both the screw and nut have the flank of the thread receiving the thrust curved to fit the balls and the nut has an inclosed passage or ball race connecting its opposite ends. By means of this construction, the screw-jack may be operated with less friction and wear than in the ordinary type.

ROTARY ENGINE.—F. M. RICHARDS and H. M. FORBES, Portage, Wis. In this engine the piston and the abutments are rotary, the abutments being mounted on shafts which are arranged at right angles with the main shaft carrying the piston. The abutments are in the form of disks, with flanges projecting into the steam room of the cylinder, and each having a portion cut away at one side to allow the piston to pass. The abutments and the piston are inclosed in a suitable casing. The engine is provided with a steam chest containing an oscillating valve. There are ports in the piston through which steam is admitted to and exhausted from the working chamber. The shafts of the revolving abutments are connected positively by gearing with the shaft which carries the piston. This novel and ingenious rotary engine cannot be fully described without the aid of illustration.

HARNESS SUSPENDING AND RELEASING APPARATUS.—JOSEPH W. HOWGATE, Wilmington, Del. The invention comprises an improved method of construction whereby the suspension and releasing devices are quite compact, easily and quickly worked, and so arranged also that the moment the harness is released the suspension device is at once reset in position by supplementary springs and raised high enough to be out of the way of the horses and fire engine. The pulling on a strap secured to the actuating lever acts off the releasing mechanism, allows the harness to fall upon the horses, and, at the same time, operates the resetting attachment.

AWNING.—CELESTIN BERGERON, New York city, N. Y. In this invention there is a combination of a vertical shaft with a horizontal awning roller located at the top of the window, connected by beveled gear and a driving mechanism or crank at the lower end of the vertical shaft attached by a universal joint, so arranged that it can be detached after the awning has been rolled up. There is also a ratchet device attached to the vertical shaft to enable the awning to be held at any desired angle. The construction prevents the awning from being tampered with by unauthorized persons.

AWNING FIXTURE.—JAMES SULLIVAN, New York city. The object of this invention is to provide a fixture through the medium of which the awning is lowered or dropped and automatically locked in position, and when the awning is raised the runners will be freed, enabling the entire awning to be carried upward to its highest position in the usual manner. The device can be economically and durably constructed.

PIANO.—BERNARD KROEGER, White Plains, N. Y. The object of this invention is to permit a specially trussed piano string frame to be readily removed from the casing of a piano, such as that styled the "Grand," whereby the case can be moved independently of the frame and consequently with less risk, inasmuch as it will be greatly lightened. Metal trusses are arranged on the underside of the sounding board free from contact therewith, for the purpose of strengthening the frame and to prevent buckling by the strings on the upper side.

Railway Appliances.

CAR AXLE BOX.—ELISHA J. HUNT, New York city, N. Y. This improved car axle box is arranged to reduce friction to a minimum and to prevent the car journals and bearings from becoming hot. The portion of the car axle in the box is provided with a corrugated wheel which meshes into a secondary corrugated wheel located above it, the axis of which supports the weight of the car frame. The ends of this axis are constructed in spherical form for the purpose of reducing friction and the prevention of end thrust. It appears to be a very satisfactory means of reducing friction.

AUTOMATIC STOP VALVES FOR HOSE COUPLINGS.—GEORGE W. EDGINGTON, Coalville, Utah. This invention is designed to provide an improved automatic stop valve, arranged to close each of the coupling members when the same is uncoupled, and prevents dust and other impurities from passing into the train pipe, thereby preventing damage to the air brake mechanism. The essential feature of the coupling consists in providing each member with two disks having perforations, one disk being movable and the other stationary. In the act of coupling, the movable disk is located so that the perforations slide over the solid portions of the stationary disk and thereby prevent the expulsion of air at the time the coupling is parted. When the ends of the coupling are placed together and locked, the rotation of the movable disks causes the apertures of each to correspond with the apertures in the stationary disks, and thereby completes the circuit of air. The simplicity of the mechanism and the certainty of its operation are very desirable features.

Miscellaneous.

MOVABLE CAISSON.—CHARLES C. LOVEJOY, New York city. The purpose of this invention is to provide an improved caisson more especially designed for use on frozen ground, in rivers or streams having bottoms of gold-bearing sand. The caisson is arranged to permit its floating about from one place to another. It can be raised or sunk at will and is provided with a working chamber for miners in its lowermost position. The caisson has a water-loading compartment in the upper portion of its casing and a working chamber in the lower portion. A compressed-air supply pipe opens into the working chamber and water-pipes lead from the working chamber into the loading compartment, so that the water is forced by the compressed air from the working chamber into the loading compartment. Doors in the bottom of the working chamber give access to the sand in the bed of the waterway.

COMBINED WAGON, SLEIGH, AND BOAT.—CHARLES BALTRUWEIT, New York city. The object of this invention is to provide a vehicle, combining a wagon, a sleigh, and a boat, and arranged to permit a convenient and rapid change from one form to the other, according to the condition of the route to be traveled. The vehicle has a front and rear axle, a bolster connected by a king-bolt with the front axle, sleigh-runners secured to the bolster and rear axle, and a boat removably carried by the runners. A pair of posts are mounted on the runners, the posts of each pair being connected with each other by a cross-beam to form supports for the boat.

CAN-TOP.—MARY E. ANDERSON, Columbia, Mo. The invention relates to can-tops and is intended to protect the contents of the can from insects, etc. The top is provided at its upper end with an internal and external or double cylinder, the said cylinders being united at their lower ends and forming an annular groove, in which is mounted a slide adapted to open and close the outlet openings in the cylinders leading to the discharge spout. When the slide is closed, all foreign substances are absolutely excluded from access to the interior of the can.

COMBINED LAUNDRY-TUB COVER AND DRAINING-BOARD.—PETER C. FISCHER, Homestead, N. J. The object of this invention is to provide a substantial cover for laundry-tubs which will not be injured by steam and which will ventilate the tub thoroughly, and which may be used as a dish-drainer or draining-board without removing the cover. It consists of a metal top hinged to a back strip. The cover has a depression forming a tray and is provided with apertures in the depressed surface whereby the cover may be used as a draining-board. A hollow, ventilated, marginal flange receives the cover, so that air may circulate even when the cover is closed.

ENVELOPE FASTENING.—CLYDE L. SMITH, Leipsic, O. The object of this invention is to provide means of an inexpensive construction by which envelopes and similar packages may be readily and effectually sealed. It consists of the envelope provided with a slot, a sealing flap adapted to enter the slot, and of a fastening plate secured to the sealing flap and having a hooked end adapted to engage the upper wall of the slot. In sealing the envelope, the sealing flap is merely inserted within the slot and it is found to fasten the same. To unseal it, it is only necessary to place the forefinger beneath the flap and move the flap toward the bottom of the envelope and then withdraw.

PROCESS OF EXTRACTING METALS FROM METALLIC OXIDES.—HEINRICH C. ASCHERMANN, Cassel, Germany. In electric furnaces, the extraction of pure metals from their oxides presents considerable difficulty when the metals have a great affinity for carbon. This is obviated in the present invention by adding to the oxides treated the sulphide of antimony in greater proportion than the oxide, and then subjecting the mixture to electric currents in a fusion furnace, the mixture forming the negative pole of the arc.

FURNACE.—JOHN S. L. RODRICK, Washington, D. C. This invention refers more particularly to an addition to

an ordinary hot air furnace for the purpose of concentrating a given amount of heat and conducting it through an interior pipe much smaller than the regular heating flue of the furnace, thereby heating the air more thoroughly in the regular furnace flue than is usual. This interior pipe is supported by radial projections in the regular flue. The method of superheating a portion of the air is to attach to the exterior of the fire chamber of the furnace a metal box, one side of which is open and is held in contact with the circular form of the fire chamber and is open at the bottom. From the top runs the conducting pipe, which carries the heat to the main flue. It appears to be a very effective appliance for heating horizontally inclined flues.

APPARATUS FOR PRODUCING ACETYLENE GAS.—THOMAS HOLLIDAY, Huddersfield, Eng. This apparatus is constructed to permit the use of the gas directly from the generator, the surplus pressure being compensated for by the weight of water in adjoining compartments. The gas holder is surmounted by a cistern of water in which is a worm pipe through which the generated gas discharges and which serves also to cool the gas. On a level with the gas holder, attached to its exterior, is a separate generator, in which is placed the basket of carbide. Extending upward from the bottom of the gas holder is a pipe communicating with the water cistern above. As the water flows from the cistern into the gas holder and fills the latter so that it overflows at the top into a pipe leading to the bottom of carbide receptacle, gas is at once generated. An excess of back pressure forces the water out of the gas holder into the cistern above. Suitable valves are provided at the bottom of the generator and gas holder for drainage and a clamped cover is upon the generator, permitting quickly the replacing of fresh for the used-up carbide.

MILL FOR CUTTING TEA.—CHARLES HENRY BARTLETT, Bristol, Eng. This invention relates to mills for cutting tea, and consists essentially of a revolving cylinder presenting cutting edges acting in conjunction with the stationary knife. The invention has for its object to avoid injury to the cutting edges of the cylinder and the knife, which is frequently caused by nails and other foreign substances in the tea. By means of a spring actuated detent, the knife is normally retained in an operative position, but it is free to yield to an excess of pressure. Friction gear comes into operation after the detent has yielded, allowing the knife to recede, the friction gear continues the motion until the knife blade is returned to operative position, the obstruction being meanwhile carried around and out by the cylinder, so that the cutting edges are not injured.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

SAJOUS' ANNUAL AND ANALYTICAL CYCLOPEDIA OF PRACTICAL MEDICINE. Vol. I. "Abdominal Injuries" to "Bright's Disease." Philadelphia: The F. A. Davis Company. 1898. Pp. 602. Cloth. 8vo. Price $5.

This is the initial volume of a work calculated to afford material aid to the general practitioner, the teacher and the student: first, by abbreviating the time and labor that has heretofore been demanded in order to critically review any medical topic; second, to obviate the necessity for accumulating a large, constantly increasing and expensive library devoted to special or exclusive subjects; third, to record every detail of progress during the previous decade, up to and including the current year; fourth, to lay the same, in connection with the negative and positive evidence, so concisely before the reader that he may at once grasp and solve a given problem with a minimum expenditure of effort; fifth, to do away with expensive medical indexes and index catalogues. Finally, the work is provided with a supplement in the form of a "Monthly Cyclopedia" that, arranged alphabetically, keeps each subject fully up to date; this monthly is a part of the cyclopedia and is a complete digest of current medical literature as well. All told, the cyclopedia will consist of six volumes, and three volumes of supplement, and will be completed early in 1900. The illustrations are of a class rarely seen in medical works, being models of clearness, exactness, and of the engraver's and lithographer's art. The editor, Dr. Charles E. De M. Sajous, and his large staff of expert associates, are to be congratulated upon the completeness, thoroughness, and eminently practical character of this work. The volume, moreover, is attractively bound and well printed.

HEAT EFFICIENCY OF STEAM BOILERS, LAND, MARINE, AND LOCOMOTIVE. With Tests and Experiments of Different Types, Heating Values of Flues, Analyses of Gases, Evaporation, and Suggestions for Testing Boilers. By Bryan Donkin. London: C. Griffin & Company, Limited. Philadelphia: J. B. Lippincott Company. 1898. 8vo. Pp. 311, 149 illustrations, tables, plates. Price $8.

The present work is a very valuable one. It is a book which no steam engineer can do without. It is filled with tables of the most valuable kind, embracing hundreds of tests by an engineer of high standing. The author has conducted many boiler tests and has collated and compared a large number of reliable tests by others, so that the principles governing combustion and efficiency in different types of boilers can be determined. The author has also added important chapters on combustion and kindred subjects. An excellent bibliography accompanies the work.

THE PHYSICAL GEOGRAPHY OF NEW JERSEY. By Rollin P. Salisbury. With an Appendix, by C. C. Vermeule. Trenton, N. J. 1898. 8vo. Pp. 200. Plates and maps.

This forms Vol. IV. of the final report of the State geologist. Like the preceding volumes, it is an important contribution to our knowledge of this State, which has been surveyed in a remarkably thorough manner. The volume will prove of great value to those who are in any way interested in geology or the State of New Jersey.

L'UTILIZZAZIONE DELLE FORZE IDRAULICHE E LA TRAZIONE ELECTRICA SULLE FERROVIE. By Marchese Achille Afan de Rivera. From the Nuova Antologia, July 16, 1898. Roma. 1898. Pp. 26.

NEUBAUTEN IN NORDAMERIKA. Berlin: Julius Becker, Friedrich-Strasse 240-241. 1898. Folio. 10 plates. Price $1.50.

This is a section of a work which will include 100 plates and which is certainly well calculated to give foreigners an idea of some of our architecture. The plates are beautifully executed and the subjects are well selected.

SUBMARINE TELEGRAPHS. THEIR HISTORY, CONSTRUCTION, AND WORKING. By Charles Bright, F.R.S.E. London: Crosby Lockwood & Company. 1898. 8vo. Pp. 743, xxxvi. 145 illustrations, plates. Price $25.

The present volume is based somewhat upon Wünschendorff's classic work, "Traité de Télégraphie Sous-Marine." Even a cursory examination shows that it is a book of great merit. A treatise on the subject has long been needed, and the book appears to admirably fill this somewhat neglected niche in electrical literature. It is surprisingly complete, and all phases of the subject, such as the history, construction, and working of submarine telegraphs, is adequately treated. For any one who wishes a thoroughly up-to-date treatise on the subject, the book can be confidently recommended. It is profusely illustrated, and the work is published in a fine form.

MILITARY EUROPE. A NARRATIVE OF PERSONAL OBSERVATION AND PERSONAL EXPERIENCE. By Major-General Nelson A. Miles. New York: Doubleday & McClure Company. 1898. Pp. 112. 4to. Plates. Price $1.50.

There is no one better fitted to write upon military Europe than General Miles, who is every inch a soldier and to whom we owe much of our military success in our war with Spain. He writes interestingly about the "Turkish and Greek Armies," the "Military and Naval Glory of England as Seen at the Queen's Jubilee," and "Military Maneuvers." There is no doubt that General Miles obtained valuable information on his trip, and it is certain that many of the good features which European armies possess would be incorporated in our own if it were not for the evidently hopeless bureaucracy at Washington.

EXPLOSIVE MATERIALS. The Phenomena and Theories of Explosion and the Classification, Constitution, and Preparation of Explosives. By Lieut. John P. Wisser, U.S.A. New York: Van Nostrand Company. 1898. Pp. 160. 16mo. Price 50 cents.

The author is an instructor in the United States Artillery School and is editor of the Journal of United States Artillery. The book gives much valuable information in regard to explosives in very condensed form.

SECOND ANNUAL REPORT OF THE COMMISSIONERS OF FISHERIES, GAME, AND FORESTS OF THE STATE OF NEW YORK. Albany. 1898. Pp. 521. 4to. Plates.

This is certainly among the finest, if not the finest publication ever issued by any State in the Union, and is a credit not only to the commissioners, but to the State as well. It shows exactly how reports should be issued. The day of dry and musty documents is certainly at an end. The volume is large, handsomely printed, freely illustrated with colored and half tone plates and is bound in rich Holliston cloth stamped in black. The subjects selected for illustration are eminently pictorial and are of the kind which will delight the hunter, the fisherman, and those who like to pass a few weeks in a mountain camp. Although a considerable part of the report is taken up with statements of accounts, reports, laws, etc., still there are chapters which are very interesting. It is surprising to see what a really valuable book can be made from materials which in other hands would have been served up in the familiar rusty black cover and which is so promptly consigned to the waste basket.

PROCEEDINGS AND PAPERS OF THE NATIONAL FISHERY CONGRESS HELD AT TAMPA, FLA., JANUARY 19 TO 24, 1898. Washington: United States Commission of Fish and Fisheries. 1898. Pp. 375. 4to.

This is an important collection of scientific papers presented at the congress, and the commission has undertaken the publication of the papers and an abstract of the proceedings.

A DETERMINATION OF THE RATIO (x) OF THE SPECIFIC HEATS AT CONSTANT PRESSURE AND AT CONSTANT VOLUME FOR AIR, OXYGEN, CARBON-DIOXIDE, AND HYDROGEN. By O. Lummer and E. Pringsheim. Washington: Published by the Smithsonian Institution. 1898. Pp. 29.

BULLETIN OF THE GEOLOGICAL INSTITUTION OF THE UNIVERSITY OF UPSALA. Edited by Hj. Sjorgren. Vol. III., 1896-1897. Upsala. 1898. Pp. 457.

The Process Year Book for 1898, published in England by Penrose & Company, which we have already reviewed, is sold in this country by G. Gennert, 24 and 26 East 10th Street, New York city. He is the American agent for this beautiful publication.

"Art Education" is a new publication devoted to art interests. It is issued by the J. C. Witter Company, 76 Fifth Avenue, New York city. This is a sumptuous quarto filled with excellent half tones and line engravings. It seems to admirably fill a much neglected niche in American journalism.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7491) J. A. A. wants to know (1) the process of mending negatives, that is, where holes are made in the film by scratching, or the film began to frill so the emulsion got soft and bare spots were made. How can these be filled up? A. Use Gihon's opaque and a pencil camel's hair brush. See also SCIENTIFIC AMERICAN SUPPLEMENT, No. 658. 2. Describe the process of solandi printing as used by botanists. A. We suppose it is like the blue print process, using a natural leaf in place of a negative. 3. What would be the proper size of a camera for amateur use and what style of lens would you recommend? A. A 4×5 hand camera with an astigmat or rapid symmetrical lens. 4. Please tell me how to make flash light cartridges? A. See formula in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1062 and 1080.

(7492) A. I. B. says: Will you do me the kindness to explain the following statement appearing on page 531 (fourth line from top of page) of the seventeenth edition of "Experimental Science," by George M. Hopkins, and published by you: "Where several lamps are connected in series and the series are connected in parallel, if one lamp of a series should fail, the other lamps of the series would be useless without some device for automatically throwing into the circuit a resistance equivalent to that of a lamp, thus maintaining the same resistance in the circuit." What I wish to know particularly is what is meant by "some device for automatically," etc. A. When electric lamps are used in series, should one of the series be extinguished, the whole of that series would go out, because of the broken circuit. To prevent the rest from going out, there is attached to the lamp an automatic device which cuts in a circuit for the current around this lamp and the current is not cut off from the series. The rest of the lamps continue to burn. This circuit around the broken lamp must have a resistance equal to that of the lamp, in order to keep the current in the series the same as before.

(7493) J. A. R. says: Can you describe the process of working carbon in making one of the elements of an electric battery cell? I wish to construct a cell of battery of my own design which will require a carbon plate of peculiar shape which cannot be supplied by electric supply houses here; so I have decided to make one, provided the process is not too difficult an undertaking. Can you give general information which will be of use to me? I thought probably carbon could be obtained in crude form, which, after undergoing a process of pulverizing and pasting together, could be made to conform to the shape required. A. Carbon plates and rods are made from pulverized coke and lampblack, mixed with gas tar or asphalt and a cheap molasses. This is pressed in moulds by hydraulic pressure, and heated in an oven to decompose the carbonaceous materials and drive off the gases. This is often repeated several times, dipping the carbons in sirup between the heatings. One formula given is:

Powdered coke	15 parts.
Calcined lamp black	5 "
Special sirup	8 "

Mix with water and mould.

The answer to query No. 7475, by some means, was printed with a slight error in it. The last sentence should read: The square root of this result is the lifting power in pounds. The formula as given in algebraic symbols is correct.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

SEPTEMBER 6, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, ester of para-amidometaoxybenzoic, A. Einhorn 610,348
Adhesive compound, C. M. Higgins 610,182
Adhesive paste compound, C. M. Higgins 610,183
Alarm. See Burglar alarm.
Anchor, expansion, D. C. Seaman et al 610,308
Axle, lubricating, J. G. Obermier 610,195
Back pedaling brake, H. M. Hunt 610,270
Back pedaling brake, P. H. White 610,507
Baling press, P. K. Dederick 610,168
Bar. See Handle bar. Tubular bar.
Barrel heading press, A. L. Swett 610,306
Battery. See Secondary battery.
Bearing, bicycle, C. E. Colegrove 610,166
Bearing end, G. G. Brown 610,341
Bearing for rotary disks, H. Ganswindt 610,232
Bearing, roller, G. W. Dickinson 610,436
Bearing, wheel, C. E. Roberts 610,531
Bell, J. Oberle 610,240
Bell, bicycle, L. Noel 610,495
Berth and settee for ships, convertible, T. R. Turner 610,421
Bicycle brake, F. E. Baldwin 610,288
Bicycle brake, O'Connor & Knowles 610,277
Bicycle handle, H. L. Cavanagh 610,471
Bicycle handle bar, J. Grady 610,352
Bicycle handle bar, adjustable, J. M. Blashfield 610,469
Bicycle handle bars, adjustable grip for, N. A. Bille 610,254
Bicycle luggage carrier, D. H. Streeper 610,288
Bicycle luggage rack, G. W. Schepman 610,244
Bicycle package carrier, D. G. Knittel 610,404
Bicycle support, J. L. Knoll 610,186
Bicycles, etc., propelling mechanism for, L. Burgess 610,582
Bill or toilet paper holder, F. Schulz 610,245
Blacking stands, foot rest for boot, F. Muller 610,363
Blasting implement, Mino & Day 610,305
Bleaching powder, process of and apparatus for making, Y. C. Driffield et al 610,265
Block. See Pulley block.
Boiler. See Stand boiler.
Bone cutting machine, C. Trick 610,335
Book, account keeping, T. G. Knight 610,451
Boot or shoe trees, fore part for, O. I. Howe 610,255
Boot tree, W. W. Watts 610,506
Bottle, C. J. Moore 610,362
Bottle corking machine, G. G. Brown 610,581
Bottle, non-refillable, H. Starck 610,311
Bottle stopper, H. L. Phillips 610,198
Box. See Match box. Music box. Paper box. Remailable box.
Box, A. B. Cowles ..... 610,[illegible]
Brake. See Back pedaling brake. Bicycle brake. Elevator brake.
Brake, H. W. Albright ..... 610,[illegible]
Brake shoe, G. Kelly 610,327
Broom, H. Thompson 610,230
Broom support, A. I. Gallaway 610,351
Buffing machine, automatic, C. H. Curtis 610,433
Burglar alarm, compressed air, W. M. Frisbie 610,482
Burner. See Gas burner. Vapor burner.
Camera, magazine, Marx & Gassner 610,453
Can lacquering machine, C. A. Burt 610,165
Cane and gaslight, combined, E. N. Dickerson 610,478
Car, Griffin & Hogan 610,442
Car, convertible hand, P. Armstrong 610,297
Car door lock, J. M. Bedford 610,427
Car door operating and locking mechanism, E. C. Vanstone 610,505
Car, dumping, Williamson & Price 610,218
Car fender, H. Lehrer 610,238
Car seat, Tesseyman & Kirby 610,289
Car wheel, W. T. Snyder 610,501
Carriage curtain catch, H. Young 610,574
Carriage curtain light frame, J. A. Edwards 610,389
Carriage, motor, W. E. Twichell 610,503
Carriage, self propelling, V. E. Pretot 610,460
Carrier. See Bicycle package carrier. Luggage carrier.
Case. See Silverware case.
Cash register, A. I. Blanchard 610,379
Case register, J. H. McCormick 610,492
Cash register and indicator, J. H. McCormick, 610,365 610,366
Caster, furniture, E. B. Slater 610,309
Cattle guard, C. G. Cozine 610,430
Chain guard, G. A. Waters 610,313
Chains, machine for manufacturing weldless, J. M. Davis 610,434
Chimney and smoke flue, masonry, C. H. Ganzel, Sr 610,396
Cigar cutter and advertising device, combination, R. Dykeman 610,388
Cigarettes, machine for making all tobacco, J. S. Detrick 610,261
Cigarettes, machine for making all tobacco, H. Robinson 610,280
Cistern cleaning device, W. M. Ricketts 610,279
Clasp. See Corset clasp.
Clavier, mute, L. Ilmer, Jr 610,448
Cleaner. See Flower pot cleaner. Window cleaner.
Clock train, electric, C. M. Crook 610,229
Clothes pins, machine for making, H. L. Mann 610,490
Coat hanger, safety, J. O. Sanford 610,572
Coloring extracts, making, W. T. Scheele 610,282
Combing machine, Wenning & Gegauff 610,404
Compasses, etc., joint for, F. H. Heath 610,574
Composite pipe, E. L. Braddock 610,224
Compressible tube, Kinne & Gartner 610,355
Corset clasp, J. A. Fitzgerald 610,480
Cotton elevator and distributer, automatic, H. J. Wheeler 610,293
Coupling. See Pipe coupling. Pipe and hose coupling. Thill coupling.
Cultivator, J. S. Ford 610,176
Cup or pail, J. W. Scoles 610,285
Current regulator, direct, F. E. Ramsay 610,413
Curtain fixing and holder, P. Casey, Jr 610,342
Curtain stretcher, lace, J. C. Whipple 610,294
Cutter. See Cigar cutter. Noodle cutter. Weed cutter.
Cutting off apparatus, J. B. Renshaw 610,330
Cycle running gear, motor, R. Gaertner 610,177
Cycle saddle, D. M. B. H. Cochrane 610,429
Dental engine, J. D. Wilkens 610,214
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Display rack, W. Best, Sr 610,163
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Door holder, G. Hall 610,399
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(Continued on page 190)

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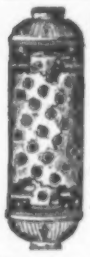

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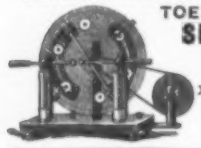

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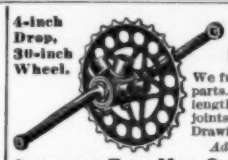

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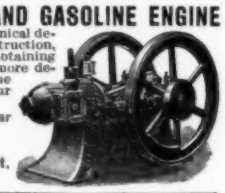

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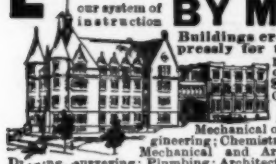

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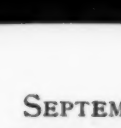

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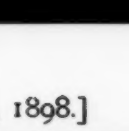

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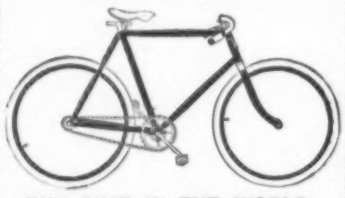

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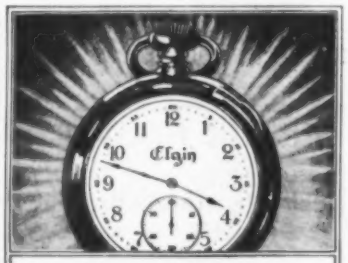

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